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History of Science, Philosophy and Culture in Indian Civilization

General Editor D.P. Chattopadhyaya

Volume I Part 1

The Dawn of Indian Civilization up to 600 BC

edited by

G.C. PANDE

PHISPC

Centre for Studies in Civilizations

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The volumes of the PROJECT ON THE HISTORY OF SCIENCE, PHILOSOPHY AND CULTURE IN INDIAN CIVILIZATION aim at discovering the main aspects of India's heritage and present them in an interrelated way. These volumes, in spite of their unitary look, recognize the difference between the areas of material civilization and those of ideational culture. The Project is not being executed by a single group of thinkers and writers who are methodologically uniform or ideologically identical in their commitments. In fact contributions are made by different scholars with different ideological persuasions and methodological approaches. The Project is marked by what may be called 'methodological pluralism'.

In spite of its primary historical character, this Project, both in its conceptualization and execution, has been shaped by many scholars drawn from different disciplines. It is for the first time that an endeavour of such a unique and comprehensive character has been undertaken to study critically a major world civilization like India.

This first volume is a new adventure in the historiography of Indian civilization. It avoids the ethnic and West-centred bias which has been a legacy of colonial historiography. It seeks strict scientific objectivity, differing from all hitherto existing volumes of this kind by giving due attention to science and philosophy in the history of Indian civilization.

The contributions are based on the first-hand and critical study of the original sources by the best known experts. While meticulously attending to chronology and hard data, the volume also seeks to understand scientific and philosophical concepts, methods and theories. It seeks to present the symbolic world of art and culture as grounded in moral vision as well as social reality. The work is designed to be of use to scholars and specially to students and general readers.

The volume is divided into six sections: Historiography; Geography and ethnography; Prehistory, Technology and Social evolution; Proto-History; The Vedas, Vedic Society and Ideas; and Foundations and Beginnings of Systematic Science.

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Publication of this Volume and much of the research it represents has been made possible by continuing grants from the Government of India which has supported multidisciplinary exploration of the Project of History of Indian Science, Philosophy and Culture.

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First published in 1999
Reprint in 2004 and 2010
by Professor Bhuvan Chandel, Member Secretary, CSC,
for the Project of History of Indian Science, Philosophy and Culture
DD-24, Kalkaji, New Delhi 110 019
Tel. No. 91-11-26227832-35, Tel. Fax No. 91-11-26227831
e-mail: csc@del2.vsnl.net.in

Distributed by
Munshiram Manoharlal Publishers Pvt. Ltd.
54, Rani Jhansi Road, New Delhi 110 055

ISBN: 81-87586-00-1

Typeset in Nalandabaskar

Views expressed in the PHISPC publications are entirely of the concerned author/authors and do not represent the views of the Project of History of Indian Science, Philosophy and Culture.

Typeset by PHISPC, New Delhi
Printed at, Tara Art Printers Pvt. Ltd., New Delhi

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D.P. CHATTOPADHYAYA, M.A., LL.B., Ph.D. (Calcutta and London School of Economics), D. Litt. (*Honoris Causa*), researched, studied Law, Philosophy and History and taught at various Universities in India, Asia, Europe and USA from 1954 to 1994. Founder-Chairman of the Indian Council of Philosophical Research (1981-1990) and President-cum-Chairman of the Indian Institute of Advanced Study, Shimla (1984-1991), Chattopadhyaya is currently the Project Director of the multidisciplinary 96-Vol. Project of History of Indian Science, Philosophy and Culture (PHISPC) and Chairman of the Centre for Studies in Civilizations (CSC). Among his 37 publications, authored 19 and edited or co-edited 18, are *Individuals and Societies* (1967); *Individuals and Worlds* (1976); *Sri Aurobindo and Karl Marx* (1988); *Anthropology and Historiography of Science* (1990); *Induction, Probability and Skepticism* (1991); *Sociology, Ideology and Utopia* (1997); *Societies, Cultures and Ideologies* (2000); *Interdisciplinary Studies in Science, Society, Value and Civilizational Dialogue* (2002); *Philosophy of Science, Phenomenology and Other Essays* (2003); *Philosophical Consciousness and Scientific Knowledge: Conceptual Linkages and Civilizational Background* (2004); *Self, Society and Science: Theoretical and Historical Perspectives* (2004); *Religion, Philosophy and Science* (2006); *Aesthetic Theories and Forms in Indian Tradition* (2008) and Love, Life and Death (2010). Besides, he held high public offices, namely, of Union cabinet minister and state governor. He was awarded Padma-bhushan in 1998 and Padma Vibhushan in 2009 by the Government of India.

G.C. PANDE, thinker, scholar, historian, regarded internationally as an authority on Buddhism and ancient Indian culture, joined the University of Allahabad, his *alma mater*, as Lecturer in History after receiving his D. Phil in 1947. Later he became Professor and Head of the Department of History of three universities–Gorakhpur, Jaipur and Allahabad. At present, he is the Chairman, Allahabad Museum Society and the Chairman-cum-President, Indian Institute of Advanced Study, Shimla.

Recipient of many honorary degrees (Vida Varidhi, Sahitya Vacaspati, Vakpati, Mahamahopadhyaya) and awards (Sankara Sammana, Manisha Sammana, etc.), he has lectured and traveled extensively in India and abroad. He has authored and edited several distinguished book and contributed over seventy articles to encyclopaedias, anthologies and journals. His *Studies in the Origins of Buddhism, Foundations of Indian Culture, Bharatiya Parampura Ke Mool Swara* and other books brought him encomiums from scholars such as Gopinath Kaviraj, Rahul Sankrityayan, Suniti Kumar Chatterji, Khetresh Chattopadhyaya, Vasudev Saran Agrawal, T.R.V. Murti, I.B. Horner, H. Nakamura and Louis Renou.

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Table of Transliteration

अ	a	आ	ā	इ	i	ई	ī		
उ	u	ऊ	ū	ऋ	ṛ	ॠ	ṝ		
ऌ	ḷ	ए	e	ऐ	ai	ओ	o		
औ	au	अं	aṁ	अः	aḥ				
क्	k	ख्	kh	ग्	g	घ्	gh	ङ्	ṅ
च्	c	छ्	ch	ज्	j	झ्	jh	ञ्	ñ
ट्	ṭ	ठ्	ṭh	ड्	ḍ	ढ्	ḍh	ण्	ṇ
त्	t	थ्	th	द्	d	ध्	dh	न्	n
प्	p	फ्	ph	ब्	b	भ्	bh	म्	m
य्	y	र्	r	ल्	l	व्	v		
श्	ś	ष्	ṣ	स्	s	ह्	h		
ळ्	ḷ	क्ष्	kṣ	त्र्	tr	ज्ञ्	jñ		

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Preface

The first volume of the History of Science, Philosophy and Culture in Indian Civilization is in three parts. The first part presented here traces the development of civilization in India up to the end of the Vedic age. The second part begins with the epics, the *sūtras*, and the heterodox movements up to the third century AD.

The general ideas underlying the historical project to which the volume belongs have been adumbrated by Professor D.P. Chattopadhyaya in his General Introduction. My Introductions to the two parts of the volume attempt to delineate the major issues and approaches which figure in them. The volume aims at an integral history of civilization in India with a focus on the development of science, philosophy and culture including society and the arts. It would be generally accepted that historiography proceeds from the critical examination of the sources to the discovery of the distinctive network of those general forces and relations which determine the specific form of the elements of any civilization. However, even while the historians seek to be objective and critical in their methods they do not reach the same conclusions on account of divergent presuppositions and approaches. Open-ended historiography cannot avoid such diversity and it is inevitably reflected in the present volume. Nevertheless, it is hoped the present volume would be seen to add substantially to the existing fund of historical knowledge both by way of new researches as well as interpretations. If it helps to draw attention to the history of civilization in general, it would succeed in its task.

Professor D.P. Chattopadhyaya is not only the illustrious founder of the Project but also its sustainer and guide. Without his continuous help and support I could not have dreamt of taking up or completing my limited task. It is the willing collaboration of many scholars which has made this work possible. I do not know how to thank them adequately. I must also record my sorrow that two of our authors—Professor Indra Pal and Dr S. Paramahansa have passed away while the volume is still to see the light of day.

The administrative, financial and editorial staff of the Project office has always been helpful. I am thankful to them and to Dr Sunil Prasad Sinha and Shri Ajay Prakash Khare, my Research Assistants, who have been constantly helping me. I am beholden to all these and many others who have helped me from time to time but who are too numerous in number to mention.

G.C. PANDE

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Contributors

D.P. Agrawal formerly worked at the Physical Research Laboratory, Ahmedabad. His published work includes *The Archaeology of India* and *The Copper Bronze Age in India.*

Sibesh Bhattacharya formerly Head, Department of Ancient History, Culture and Archaeology, University of Allahabad. His published work includes *Some Aspects of Indian Society from 2nd Century BC to 4th Century AD.* He was British Council Scholar in England, 1972–73 and Sectional President, Indian History Congress.

R.S. Bisht was till recently Director, Institute of Archaeology, Archaeological Survey of India, New Delhi. He is well-known as the Excavator of Dholavira. Apart from many research papers and reports, his published work includes, in collaboration with J. P. Joshi, *India and the Indus Civilization.* Currently, he is Director (Excavation) in the Archaeological Survey of India.

Prem Sagar Chaturvedi teaches at the Department of Ancient History, Culture and Archaeology, University of Gorakhpur. His published work includes *Technology in Vedic Literature.*

S.P. Gupta worked in the Archaeological Survey of India, the National Museum of India, New Delhi and was Director, Allahabad Museum. He is currently Chairman, Institute of Archaeology, New Delhi. His published works include *Archaeology of Soviet Central Asia and the Indian Borderlands, Roots of Indian Art,* and *Saraswati Indus Civilization.*

Kishore Nath Jha teaches at the G.N. Jha Kendriya Sanskrit Vidyapith, Allahabad and specializes in Nyaya and Mimamsa and has published several works on the subject including the editions of *Ajita* (2 Volumes) *Nyāya Tatvoloka.*

S.N. Jha is a Reader in Jyotish in the Kendriya Sanskrit Vidyapith, Lucknow. He has published several papers. He is a Sanskritist and an astronomer.

Jagat Pati Joshi was formerly Director-General of the Archaeological Survey of India. His published works include *Excavations at Bhagwanpura* and *Excavations at Surkotada.* Currently, he is conducting excavations near Nagpur.

Subhash Kak is Professor of Electrical and Computer Engineering in the Louisiana State University, Louisiana. He is also a Sanskritist. His published works include many research papers and *Astronomical Code of the Rig Veda, The Nature of Physical Reality, India at Century's End.* In collaboration with others he is also the author of *In Search of the Cradle of Civilization.*

B.B. Lal was formerly Director-General, Archaeological Survey of India and also Professor of Archaeology at the Jiwaji University, Gwalior. He excavated Kalibangan and conceived the

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Ramayana Project. His published works include, apart from many papers and reports, *The Earliest Civilization of South Asia.*

V.D. Misra is currently Professor and Head, Department of Ancient History, Culture and Archaeology, University of Allahabad. He has published several archaeological reports in collaboration with his colleagues on the archaeology of the Middle Ganga Valley. Among his archaeological reports, the excavation at Mahadaha is prominent. Along with Professor G.R. Sharma he published an important monograph, viz., *Beginnings of Agriculture.* Currently, he is excavating at Jhusi.

Indra Pal was Professor and Head, Department of Geography, University of Rajasthan, Jaipur. His published work includes *Changing Contours of Arid Ecology* (2 Volumes). He passed away a couple of years ago.

G.C. Pande was formerly Professor, Ancient History, Culture and Archaeology, University of Gorakhpur; Tagore Professor of Indian Culture and History, Rajasthan University, Jaipur; Head of the Department of Ancient History, Culture and Archaeology, University of Allahabad. He was also Visiting Gaekwad Professor, Banaras Hindu University; and National Fellow, Indian Council of Historical Research. He was Vice Chancellor, University of Rajasthan, Jaipur and Allahabad University, Allahabad . Currently, he is Chairman, Allahabad Museum Society and Indian Institute of Advanced Studies, Shimla. His published works include, *Studies in the Origins of Buddhism, Foundations of Indian Culture* (2 Volumes), *Life and Thought of Śaṅkarācārya, Meaning and Process of Culture, Aspects of Mahāyāna.*

Sushila Pant is Professor and Head of the Department of Ancient History, Culture and Archaeology, Vikram University, Ujjain. He has specialised in Prehistoric Rock Art and Buddhist Art.

S.A. Paramhans was Senior Research Scientist, Department of Applied Mathematics in the Institute of Technology, Banaras Hindu University, Varanasi. Although his specialization was in Algebra, he also worked on the history of science. On the other hand, he was also a scholar of Vedanta and Navya Nyaya. He published many research papers and published a work on Vedantic epistemology in Sanskrit. He passed away this year.

K.V. Raman was head of the Department of Ancient Indian History and Archaeology, University of Madras. His published works include *Excavation at Uraivur* and *Brahmi Inscriptions of Tamil Nadu.*

S.N. Roy was Professor and Head, Department of Ancient History, Culture and Archaeology, University of Allahabad. He specialized in Puranic Studies, Palaeography and Numismatics on which his published work is well known. Currently working as Research Fellow at the National Museum, Allahabad.

Arvind Sharma is Birks Professor of Comparative Religions at the McGill University, Montreal. He is also a Sanskritist. His published works include *Our Religions, Hinduism For Our Times, The Philosophy of Religion—Buddhist Perspective.*

P.V. Sharma was formerly Professor and Dean, Banaras Hindu University and also Vice Chancellor, Gurukul Kangri University, Haridwar. He has published numerous works including *History of Medicine in India, Āyurveda Kā Vaijñānika Itihāsa, Vāgbhaṭṭa Vivecnā,* etc.

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Rama Nath Sharma is currently Professor of Sanskrit, Department of Indo-Pacific Languages, University of Hawaii, Honolulu. Three volumes of his magnum opus *Astadhyayi* have been published. His writings combine traditional as well as modern learning.

Purushottam Singh is Professor in the Department of Ancient Indian History, Culture and Archaeology, Banaras Hindu University, Varanasi. His published work includes *Excavation at Narhan.*

Prakash Sinha teaches Archaeology in the Department of Ancient History, Culture and Archaeology, University of Allahabad. He has visited the Institute of Archaeology, London on a Commonwealth Fellowship. He has also been awarded the E.H. Scholarship of Royal Anthropological Institute of Great Britain and Ireland. His published work includes *Model for Land Use in Late Acheulean Tradition (Satna District, M.P).*

V.C. Srivastava is presently Manindra Chandra Nandi Professor and Head, Department of Ancient Indian History, Culture and Archaeology, Banaras Hindu University, Varanasi. His published work includes *Sun Worship in Ancient India, Prehistoric Afghanistan: A Source Book, Protohistoric Afghanistan: A Source Book.* He was Visiting Professor at the Kabul University, 1978–82 and Visiting Fellow at several European Universities.

Badri Narayan Tiwari is lecturer in Social Anthropology in G.B. Pant Social Science Institute, Jhusi, Allahabad. His published work relates to subaltern history and the historical use of folklore. He is also a well known poet.

Vibha Tripathi teaches Archaeology in the Department of Ancient Indian History, Culture and Archaeology, Banaras Hindu University, Varanasi. Her work relates specially to the archaeology of the Iron age on which she has published a number of research papers. Her published works include *Painted Grey Ware* and *Iron Age Culture of Northern India.*

Radha Kant Verma was Professor and Head, Department of Ancient History, Culture and Archaeology, A.P.S. University, Rewa. Earlier he taught at the University of Allahabad. He has specialized in Prehistoric and Protohistoric Archaeology and has also been working on Rock paintings. Apart from many research papers and archaeological reports, his published work includes *Mesolithic Age in Mirzapur.*

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General Introduction

I

It is understandable that man, shaped by Nature, would like to know Nature. The human ways of knowing Nature are evidently diverse, theoretical and practical, scientific and technological, artistic and spiritual. This diversity has, on scrutiny, been found to be neither exhaustive nor exclusive. The complexity of physical nature, life-world and, particularly, human mind is so enormous that it is futile to follow a single method for comprehending all the aspects of the world in which we are situated.

One need not feel bewildered by the variety and complexity of the worldly phenomena. After all, both from traditional wisdom and our daily experience, we know that our own nature is not quite alien to the structure of the world. Positively speaking, the elements and forces that are out there in the world are also present in our body-mind complex, enabling us to adjust ourselves to our environment. Not only the natural conditions but also the social conditions of life have instructive similarities between them. This is not to underrate in any way the difference between the human ways of life all over the world. It is partly due to the variation in climatic conditions and partly due to the distinctness of production-related tradition, history and culture.

Three broad approaches are discernible in the works on historiography of civilization, comprising science and technology, art and architecture, social sciences and institutions. Firstly, some writers are primarily interested in discovering the general laws which govern all civilizations spread over different continents. They tend to underplay what they call the noisy local events of the external world and peculiarities of different languages, literatures and histories. Their accent is on the unity of Nature, the unity of science and the unity of mankind. The second group of writers, unlike the generalist or transcendentalist ones, attach primary importance to the distinctiveness of every culture. To these writers human freedom and creativity are extremely important and basic in character. Social institutions and the cultural articulations of human consciousness, they argue, are bound to be expressive of the concerned people's consciousness. By implication they tend to reject concepts like archetypal consciousness, universal mind and providential history. There is a third group of writers who offer a composite picture of civilizations, drawing elements both from their local as well as common characteristics. Every culture has its local roots and peculiarities. At the same time, it is pointed out that due to demographic migration and immigration over the centuries an element of compositness emerges almost in every culture. When due to a natural calamity or political exigencies people move from one part of the world to another, they carry with them, among other things, their language, cultural inheritance and their ways of living.

In the light of the above facts, it is not at all surprising that comparative anthropologists and philologists are intrigued by the striking similarity between different language families and the rites, rituals and myths of different peoples. Speculative philosophers of history, heavily relying on the findings of epigraphy, ethnography, archaeology and theology, try to show in very general terms that the particulars and universals of culture are 'essentially' or 'secretly' interrelated. The spiritual aspects of culture like dance and music, beliefs pertaining

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to life, death and duties, on analysis, are found to be mediated by the material forms of life like weather forecasting, food production, urbanization and invention of script. The transition from the oral culture to the written one was made possible because of the mastery of symbols and rules of measurement. Speech precedes grammar, poetry prosody. All these show how the 'matters' and 'forms' of life are so subtly interwoven.

II

The PHISPC publications on History of Science, Philosophy and Culture in Indian Civilization, in spite of their unitary look, do recognize the differences between the areas of material civilization and those of ideational culture. It is not a work of a single author. Nor is it being executed by a group of thinkers and writers who are methodologically uniform or ideologically identical in their commitments. In conceiving the Project we have interacted with, and been influenced by, the writings and views of many Indian and non-Indian thinkers.

The unity of this Project lies in its aim and inspiration. We have in India many scholarly works written by Indians on different aspects of our civilization and culture. Right from the pre-Christian era to our own time, India has drawn the attention of various countries of Asia, Europe and Africa. Some of these writings are objective and informative and many others are based on insufficient information and hearsay, and therefore not quite reliable, but they have their own value. Quality and view-points keep on changing not only because of the adequacy and inadequacy of evidence but also, and perhaps more so, because of the bias and prejudice, religious and political conviction, of the writers.

Besides, it is to be remembered that history, like Nature, is not an open book to be read alike by all. The past is mainly enclosed and only partially disclosed. History is, therefore, partly objective or 'real' and largely a matter of construction. This is one of the reasons why some historians themselves think that it is a form of literature or art. However, it does not mean that historical construction is 'anarchic' and arbitrary. Certainly, imagination plays an important role in it.

But its character is basically dependent upon the *questions* which the historian raises and wants to understand or answer in terms of the ideas and actions of human beings in the past ages. In a way, history, somewhat like the natural sciences, is engaged in answering questions and in exploring relationships of cause and effect between events and developments across time. While in the natural sciences, the scientist poses questions about nature in the form of hypotheses, expecting to elicit authoritative answers to such questions, the historian studies the past, partly for the sake of understanding it for its own sake and partly also for the light which the past throws upon the present, and the possibilities which it opens up for moulding the future. But the difference between the two approaches must not be lost sight of. The scientist is primarily interested in discovering laws and framing theories in terms of which different events and processes can be connected and anticipated. His interest in the conditions or circumstances attending the concerned events is secondary. Therefore, scientific laws turn out to be basically abstract and easily expressible in terms of mathematical language. In contrast, the historian's main interest centres round the *specific* events, human ideas and actions, not *general* laws. So, the historian, unlike the scientist, is obliged to pay primary attention to the circumstances of the events he wants to study. Consequently, history, like most other humanistic disciplines, is concrete and particularist. This is not to deny the obvious truth that historical events and processes consisting of human ideas and actions show some trend or other and weave some pattern or other. If these trends and patterns were not there at all in history, the study of history as a branch of knowledge would not have been

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profitable or instructive. But one must recognize that historical trends and patterns, unlike scientific laws and theories, are not general or purported to be universal in their scope.

III

The aim of this Project is to discover the main aspects of Indian culture and present them in an interrelated way. Since our culture has influenced, and has been influenced by, the neighbouring cultures of West Asia, Central Asia, East Asia and South East Asia, attempts have been made here to trace and study these influences in their mutuality. It is well known that during the last three centuries, European presence, both political and cultural, in India has been very widespread. In many volumes of the Project considerable attention has been paid to Europe and through Europe to other parts of the world. For the purpose of a comprehensive cultural study of India, the existing political boundaries of the South Asia of today are more of a hindrance than help. Cultures, like languages, often transcend the bounds of changing political territories.

If the inconstant political geography is not a reliable help to the understanding of the layered structure and spread of culture, a somewhat comparable problem is encountered in the area of historical periodization. Periodization or segmenting time is a very tricky affair. When exactly one period ends and another begins is not precisely ascertainable. The periods of history designated as ancient, modern and medieval are purely conventional and merely heuristic in character. The varying scopes of history, local, national and continental or universal, somewhat like the periods of history, are unavoidably fuzzy and shifting. Amidst all these difficulties, the volume-wise details have been planned and worked out by the editors in consultation with the Project Director and the General Editor. I believe that the editors of different volumes have also profited from the reactions and suggestions of the contributors of individual chapters in planning the volumes.

Another aspect of Indian history which the volume editors and contributors of the Project have carefully dealt with is the distinction and relation between civilization and culture. The material conditions which substantially shaped Indian civilization have been discussed in detail. From agriculture and industry to metallurgy and technology, from physics and chemical practices to the life sciences and different systems of medicines—all the branches of knowledge and skill which directly affect human life—form the heart of this Project. Since the periods covered by the PHISPC are extensive—prehistory, proto-history, early history, medieval history and modern history of India—we do not claim to have gone into all the relevant material conditions of human life. We had to be selective. Therefore, one should not be surprised if one finds that only some material aspects of Indian civilization have received our pointed attention, while the rest have been dealt with in principle or only alluded to.

One of the main aims of the Project has been to spell out the first principles of the philosophy of different schools, both pro-Vedic and anti-Vedic. The basic ideas of Buddhism, Jainism and Islam have been given their due importance. The special position accorded to philosophy is to be understood partly in terms of its proclaimed unifying character and partly it is to be explained in terms of the fact that different philosophical systems represent alternative world-views, cultural perspectives, their conflict and mutual assimilation.

Most of the volume editors and at their instance the concerned contributors have followed a middle path between the extremes of narrativism and theoreticism. The underlying idea has been this. If in the process of working out a comprehensive Project like this every contributor attempts to narrate all those interesting things that he has in the back of his mind, the enterprise is likely to prove unmanageable. If, on the other hand, particular details are consciously forced into a fixed mould or pre-supposed theoretical structure, the details lose

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their particularity and interesting character. Therefore, depending on the nature of the problem of discourse, most of the writers have tried to reconcile in their presentation, the specificity of narrativism and the generality of theoretical orientation. This is a conscious editorial decision. Because, in the absence of a theory, however inarticulate it may be, the factual details tend to fall apart. Spiritual network or theoretical orientation makes historical details not only meaningful but also interesting and enjoyable.

Another editorial decision which deserves spelling out is the necessity or avoidability of duplication of the same theme in different volumes or even in the same volume. Certainly, this Project is not an assortment of several volumes. Nor is any volume intended to be a miscellany. This Project has been designed with a definite end in view and has a structure of its own. The character of the structure has admittedly been influenced by the variety of the themes accommodated within it. Again it must be understood that the complexity of structure is rooted in the aimed integrality of the Project itself.

IV

Long and in-depth editorial discussion has led us to several unanimous conclusions. Firstly, our Project is going to be *unique,* unrivalled and discursive in its attempt to integrate different forms of science, technology, philosophy and culture. Its comprehensive scope, continuous character and accent on culture distinguish it from the works of such Indian authors as P.C. Ray, B.N. Seal, Binoy Kumar Sarkar and S.N. Sen and also from such Euro-American writers as Lynn Thorndike, George Sarton and Joseph Needham. Indeed, it would be no exaggeration to suggest that it is for the first time that an endeavour of so comprehensive a character, in its exploration of the social, philosophical and cultural characteristics of a distinctive world civilization—that of India—has been attempted in the domain of scholarship.

Secondly, we try to show the linkages between different branches of learning as different modes of experience in an *organic* manner and without resorting to a kind of reductionism, materialistic or spiritualistic. The internal dialectics of organicism without reductionism allows fuzziness, discontinuity and discreteness within limits.

Thirdly, positively speaking, different modes of human experience—scientific, artistic, etc., have their own individuality, not necessarily autonomy. Since all these modes are modification and articulation of *human* experience, these are bound to have between them some finely graded commonness. At the same time, it has been recognized that reflection on different areas of experience and investigation brings to light new insights and findings. Growth of knowledge requires humans, in general, and scholars, in particular, to identify the distinctness of different branches of learning.

Fourthly, to follow simultaneously the twin principles of, (a) individuality of human experience as a whole, and (b) individuality of diverse disciplines, are not at all an easy task. Overlap of themes and duplication of the terms of discourse become unavoidable at times. For example, in the context of *Dharmaśāstra,* the writer is bound to discuss the concept of value. The same concept also figures in economic discourse and also occurs in a discussion on fine arts. The conscious editorial decision has been that, while duplication should be kept to its minimum, for the sake of intended clarity of the themes under discussion their reiteration must not be avoided at high intellectual cost.

Fifthly, the scholars working on the Project are drawn from widely different disciplines. They have brought to our notice an important fact that has clear relevance to our work. Many of our contemporary disciplines like economics and sociology did not exist, at least not in their present form, just two centuries ago or so. For example, before the middle of nineteenth century, sociology as a distinct branch of knowledge was unknown. The term is said to have

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been coined first by the French philosopher Auguste Comte in 1838. Obviously, this does not mean that the issues discussed in sociology were not there. Similarly, Adam Smith's (1723-90) famous work *The Wealth of Nations* is often referred to as the first authoritative statement of the principles of (what we now call) economics. Interestingly enough, the author was equally interested in ethics and jurisprudence. It is clear from history that the nature and scope of different disciplines undergo change, at times very radically, over time. For example, in India by *Arthaśāstra* we do not mean the science of economics as understood today. Besides the principles of economics, it discusses at length those of governance, diplomacy and military science.

Sixthly, this brings us to the next editorial policy followed in the Project. We have tried to remain very conscious of what may be called indeterminacy or inexactness of translation. When a word or expression of one language is translated into another, some loss of meaning or exactitude seems to be unavoidable. This is true not only in the bilingual relations like Sanskrit-English and Sanskrit-Arabic, but also in those of Hindi-Tamil and Hindi-Bengali. In recognition of the importance of language-bound and context-relative character of meaning we have solicited from many learned scholars' contributions, written in vernacular languages. In order to minimize the miseffect of semantic inexactitude we have solicited translational help of that type of bilingual scholars who know both English and the concerned vernacular language, Hindi, Tamil, Telegu, Bengali or Marathi.

Seventhly and finally, perhaps the place of technology as a branch of knowledge in the composite universe of science and art merits some elucidation. Technology has been conceived in very many ways, e.g., as autonomous, as 'standing reserve', as liberating or enlargemental, and alienative or estrangemental force. The studies undertaken by the Project show that, in spite of its much emphasized mechanical and alienative characteristics, technology embodies a very useful mode of knowledge that is peculiar to man. The Greek root words of technology are *techne* (art) and *logos* (science). This is the basic justification of recognizing technology as closely related to both epistemology, the discipline of valid knowledge, and axiology, the discipline of freedom and values. It is in this context that we are reminded of the definition of man as *homo technikos*. In Sanskrit the word closest to *techne* is *kalā* which means any practical art, any mechanical or fine art. In the Indian tradition, in *Śaivatantra,* for example, among the arts *(kalā)* are counted dance, drama, music, architecture, metallurgy, knowledge of dictionary, encyclopedia and prosody. The closeness of the relation between arts and sciences, technology and other forms of knowledge are evident from these examples and was known to the ancient people. The human quest for knowledge involves the use both head and hand. Without mind, the body is a corpse and disembodied mind a bare abstraction. Even for our appreciation of what is beautiful and the creation of what is valuable, we are required to exercise both our intellectual competence and physical capacity. In a manner of speaking, one might rightly affirm that our psychosomatic structure is a functional connector between what we are and what we could be, between the physical and the beyond. To suppose that there is a clear-cut distinction between the physical world and the psychosomatic one amounts to denial of the possible emergence of higher logico-mathematical, musical and other capacities. The very availability of aesthetic experience and creation proves that the supposed distinction is somehow overcome by what may be called the bodily self or embodied mind.

V

The ways of classification of arts and sciences are neither universal nor permanent. In the Indian tradition, in the *Ṛgveda,* for example, *vidyās* (or sciences) are said to be four in number:

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(i) *Trayī*, the triple Veda; (ii) *Ānvīkṣikī*, logic and metaphysics; (iii) *Daṇḍa-nīti*, science of government; (iv) *Vārtta*, practical arts such as agriculture, commerce, medicine, etc. Manu speaks of a fifth *vidyā*, viz., *Ātma-vidyā*, knowledge of self or of spiritual truth. According to many others, *vidyā* has fourteen divisions, viz., the four *Vedas*, the six *Vedāṅgas*, the *Purāṇas*, the *Mīmāṁsā*, *Nyāya*, and *Dharma* or law. At times, the four *Upa-vedas* are also recognized by some as *vidyā*. *Kalās* are said to be 33 or even 64.

In the classical tradition of India, the word *śāstra* has at times been used as synonym of *vidyā*. *Vidyā* denotes instrument of teaching, manual or compendium of rules, religious or scientific treatise. The word *śāstra* is usually found after the word referring to the subject of the book, e.g., *Dharma-śāstra*, *Artha-śāstra*, *Alaṁkāra-śāstra* and *Mokṣa-śāstra*. Two other words which have been frequently used to denote different branches of knowledge are *jñāna* and *vijñāna*. While *jñāna* means knowing, knowledge, especially the higher form of it; *vijñāna* stands for the act of distinguishing or discerning, understanding, comprehending and recognizing. It means worldly or profane knowledge as distinguished from *jñāna*, knowledge of the divine.

It must be said here that the division of knowledge is partly conventional and partly administrative or practical. It keeps on changing from culture to culture, from age to age. It is difficult to claim that the distinction between *jñāna* and *vijñāna* or that between science and art is universal. It is true that even before the advent of modern age, both in the East and the West, two basic aspects of sciences started gaining recognition. One is the *specialized character* of what we call scientific knowledge. The other is the concept of *trained skill* which was brought close to scientific knowledge. In the medieval Europe, the expression 'the seven liberal sciences' has so often been used simultaneously with 'the seven liberal arts', meaning thereby, the group of studies by the *Trivium* (Grammar, Logic and Rhetoric) and *Quadrivium* (Arithmetic, Music, Geometry and Astronomy).

It may be observed here, as has already been alluded to earlier, that the division between different branches of knowledge, between theory and practice, was not pushed to an extreme extent in the early ages. *Praxis*, for example, was recognized as the prime *techne*. The Greek word, *technologia* stood for systematic treatment, for example, of Grammar. *Praxis* is not the mere application of *theoria*, unified vision or integral outlook, but it also stands for the active impetus and base of knowledge. In India, one often uses the terms *Prayukti-vidyā* and *Prayodyogika-vidyā* to emphasize the practical or applicative character of knowledge. *Prayoga* or application is both the test and base of knowledge. Doing is the best way of knowing and learning.

That one and the same word may mean different 'things' or concepts in different cultures and thus create confusion has already been stated before. Two such words which in the context of this Project under discussion deserve special mention are *dharma* and *itihāsa*. Ordinarily, *dharma* in Sanskrit-rooted languages is taken to be conceptual equivalent of the English word *religion*. But, while the meaning of religion is primarily theological, that of *dharma* seems to be manifold. Literally, *dharma* stands for that which is established or that which holds people steadfastly together. Its other meanings are law, rule, usage, practice, custom, ordinance and statute. Spiritual or moral merit, virtue, righteousness and good works are also denoted by it. Further, *dharma* stands for natural qualities like burning (of fire), liquidity (of water) and fragility (of glass). Thus one finds that meanings of *dharma* are of many types—legal, social, moral, religious or spiritual, and even ontological or physical. All these meanings of *dharma* have received due attention of the writers in the relevant contexts of different volumes.

This Project, being primarily historical as it is, has naturally paid serious attention to the different concepts of history—epic-mythic, artistic-narrative, scientific-causal, theoretical and ideological. Perhaps the point that must be mentioned first about history is that it is not a

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correct translation of the Sanskrit word *itihāsa*. Etymologically, it means what really happened (*iti-ha-āsa*). But, as we know, in the Indian tradition *purāṇa* (legend, myth, tale, etc.), *gāthā* (ballad), *itivṛtta* (description of past occurrence, event, etc.), *ākhyāyikā* (short narrative) and *vaṃśa-carita* (genealogy) have been consciously accorded a very important place. Things started changing with the passage of time and particularly after the effective presence of Islamic culture in India. Islamic historians, because of their own cultural moorings and the influence of the Semitic and Graeco-Roman cultures on them, were more particular about their facts, figures and dates than their Indian predecessors. Their aim to bring history close to statecraft, social conditions and the lives and teachings of the religious leaders imparted a mundane character to this branch of learning. The Europeans whose political appearance on the Indian scene became quite perceptible only towards the end of the eighteenth century brought in with them their own view of historiography in their cultural baggage. The impact of the Newtonian Revolution in the field of history was very faithfully worked out, among others, by David Hume (1711-76) in *History of Great Britain from the Invasion of Julius Caesar to the Revolution of 1688* (6 vols., 1754-62) and Edward Gibbon (1737-94) in *The History of the Decline and Fall of the Roman Empire* (6 vols., 1776-88). Their emphasis on the principles of causality, datability and continuity/linearity of historical events introduced the spirit of scientific revolution in European historiography. The introduction of English education in India and the exposure of the elites of the country to it largely account for the decline of the traditional concept of *itihāsa* and the rise of the post-Newtonian scientific historiography. Gradually, Indian writers of our own history and cultural heritage started using more and more European concepts and categories. This is not to suggest that the impact of the European historiography on Indian historians was entirely negative. On the contrary, it imparted an analytical and critical temper which motivated many Indian historians of the nineteenth century to try to discover and represent our heritage in a new way.

VI

The principles which have been followed for organizing the subjects of different volumes under this Project may be stated in this way. We have kept in view the main structures which are discernible in the decomposible composition of the world. The first structure may be described as physical and chemical. The second structure consists, broadly speaking, of biology, psychology and epistemology. The highest and the most abstract structure nests many substructures within it, for example, logic, mathematics and musical notes. It is well known that the substructures within each structure are interactive, i.e., not isolable. The more important point to be noted in this connection is this. The basic three structures of the world, viz., (a) physico-chemical, (b) bio-psychological, and (c) logico-mathematical are all simultaneously open to upward and downward causation. In other words, while the physico-chemical structure can causally influence the bio-psychological one and the latter can causally influence the most abstract logico-mathematical, the reverse process of causation is also operative in the world. In spite of its relative abstractness and durability, the logico-mathematical world has its downward causal impact on our bio-psychological and epistemological processes and products. And the latter can also bring about change in the structures of the physical world and its chemical composition. Applied physics and bio-technology make the last point abundantly clear.

Many philosophers, life-scientists, and social scientists highlight the point that nature loves hierarchies. Herbert Simon, the economist and the management scientist, speaks of four steps of partial ordering of our world, namely; (i) chemical substances, (ii) living organisms, tissues and organs, (iii) genes, chromosomes and DNA, and (iv) human beings,

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the social organizations, programmes and information process. All these views are in accord with the anti-reductionist character of our Project. Many biologists defend this approach by pointing out that certain characteristics of biological phenomena and process like unpredictability, randomness, uniqueness, magnitude of stochastic perturbations, complexity and emergence cannot be reduced without recource to physical laws.

The main subjects dealt with in different volumes of the Project are connected not only conceptually and synchronically but also historically or diachronically. For pressing practical reasons, however, we did not aim at presenting the prehistorical, proto-historical and historical past of India in a continuous or chronological manner. Besides, it has been shown in the presentations of the PHISPC that the process of history is non-linear. And this process is to be understood in terms of human praxis and absence of general laws in history. Another point which deserves special mention is that the editorial advisors have taken a conscious decision not to make this historical Project primarily political. We felt that this area of history has always been receiving extensive attention. Therefore, the customary discussion of dynastic rule and succession will not be found in a prominent way in this series. Instead, as said before, most of the available space has been given to social, scientific, philosophical and other cultural aspects of Indian civilization.

Having stated this, it must be admitted that our departure from conventional style of writing Indian history is not total. We have followed an inarticulate framework of time in organizing and presenting the results of our studies. The first volume, together with its parts, deals with the prehistorical period to AD 300. The next two volumes, together with their parts, deal with, among other things, the development of social and political institutions and philosophical and scientific ideas from AD 300 to the beginning of the eleventh century AD. The next period with which this Project is concerned spans from the twelfth century to the early part of the eighteenth century. The last three centuries constitute the fourth period covered by this Project. But, as said before, the definition of all these periods by their very nature are inexact and merely indicative.

Two other points must be mentioned before I conclude this General Introduction to the series. The history of some of the subjects like religion, language and literature, philosophy, science and technology cannot for obvious reason be squeezed within the cramped space of the periodic moulds. Attempts to do so result in thematic distortion. Therefore, the reader will often see the overflow of some ideas from one period to another. I have already drawn attention to this tricky and fuzzy and also the misleading aspects of the periodization of history, if pressed beyond a point.

Secondly, strictly speaking, history knows no end. Every age rewrites its history. Every generation, beset with new issues, problems and questions, looks back to its history and reinterprets and renews its past. This shows why history is not only contemporaneous but also futural. Human life actually knows no separative wall between its past, present and future. Its cognitive enterprises, moral endeavours and practical activities are informed of the past, oriented by the present and addressed to the future. This process persists, consciously or unconsciously, wittingly or unwittingly. In the narrative of this Project, we have tried to represent this complex and fascinating story of Indian civilization.

Centre for Studies in Civilizations
Delhi, April, 1998

D.P. CHATTOPADHYAYA
General Editor and Project Director

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Introduction[1]

G.C. Pande

COLONIAL HISTORIOGRAPHY

The modern historiography of India began in the colonial era and was part of the attempt of British scholars, missionaries and civilians to understand the people over whom the colonial sway extended. This attempt was frequently combined with the attempt to justify the presence of the British in India. The combination of scientific curiosity with colonial politics gave this historiography its distinctive character. Thus James Mill, the celebrated Philosophical Radical who worked in the office of the East India Company authored *The History of British India*[2] where it is suggested that, considering the traditional society and character of the Indians, the criteria of rationalism and utilitarianism would justify the progressive nature of British rule. It may be recalled that the Philosophical Radicals were then engaged in pleading for a reform of the laws and institutions of the mother country itself and this reforming enthusiasm, along with its failure to see the imponderable virtues of tradition or the more palpable exploitative evil of colonial economy, extended to many civilians in India.[3] William Bentick and Macaulay, Malcolm and Munroe exemplify this fairly numerous class.[4] Elphinstone in his *History of India* wondered how a people devoid of manliness and veracity could ever rise to that peak of civilization to which the Indians actually rose. The work of the orientalists, philologists and antiquarians provides another aspect of colonial scholarship. William Jones, Colebrooke, Cowell and Hopkins exemplify the assiduous scholarship which sought to reveal the Indian civilization to the West. Max Müller produced the first printed edition of the *Ṛgveda*. Macdonell and Wackernagel, Oldenberg, Keith and others put the study of Vedic language, mythology and religion on its modern footing. Hopkins studied the epics, T.W. Rhys Davids, Pāli Buddhism. Max Müller in his *India, What Can It Teach Us?* raises the question of the relevance of Indian studies thus, 'India could either teach us nothing that we do not know already, or teach something which we do not care to know.' This question still remains important for many scientists, philosophers and social scientists who, accepting the principle of linear evolution, believe that the best approximation to truth so far has occurred today. If the colonial historians read the history of Indian religion largely as the history of myth and superstition, they saw Indian society as essentially held in the vice of primitive customs. Caste, as the precipitate of racial discrimination and tribal customs, was seen as its hallmark. Indian polity was simply oriental despotism and Vincent Smith's celebrated *Oxford History of India* argued that the Indian political scene is apt to revert to an anarchic condition once the strong hand of an imperial conqueror is withdrawn. It emerges from the political histories of the colonial era that the Indian people have shown a lack of virtue in the ancient Roman sense, a lack of the love of freedom and of the public character that sustains it. The forces governing Indian political history traditionally seem to be no more than those of dull habit, fitful force and ubiquitous deception. Since the newly imposed system

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of education was based on the assumption that the Indian tradition of learning was devoid of the scientific spirit or achievement, little attention was devoted to any serious studies of Indian science. Some brief surveys of Indian astronomy and mathematics were, however, made and deemed definitive. The art histories of Fergusson and Smith argued that the history of Indian art has been written in decay since it began with the imitation of Hellenistic-Roman art. Histories of literature and philosophy were attempted largely in the context of religious systems.

It would be seen that, on the one hand, the colonial and orientalist historiography of India suffered, from the defect of ethnic prejudice. On the other, its great contribution has been the introduction of modern research methods. New sources were discovered, texts critically edited and studied with respect to their date and authenticity. Attempts were also made whereby some texts could be translated and historically interpreted. A critical outlook and a sense of chronology were introduced in the understanding of India's past which had lain for some time under a fog of myth, legend and uncritical tradition. Archaeology, with its constituent and ancillary disciplines was introduced as a new science to check and amplify historical records.

NATIONALIST HISTORIOGRAPHY

At the same time, the colonial period also saw the rise of the struggle for freedom and the emergence of nationalist historiography. As examples, one could refer to the works of Romesh Dutt, R.C. Majumdar, Radha Kumud Mookerji, K.P. Jayaswal, D.R. Bhandarkar, H.C. Raychaudhary, R.P. Tripathi, Neel Kantha Shastri, Jaya Chandra Vidyalankar and others. As far as strict historical research is concerned, there is a substantial continuity between different schools of historians but at the level of historical narrative covering larger events and periods or narratives with an explanatory intent, differences inevitably emerge on account of different general suppositions, evaluations or choice of focus. One kind of narrative continued to emphasize the role of conquering rulers, the other sought to reconstruct the evolution of national life and tradition.

If the focus of historiography was primarily political and philological in the days of colonial rule and the freedom struggle, it has tended to shift to socio-economic and cultural history or archaeology in the independence period. Several multi-volumed histories of Indian civilization have been and are being brought out. Several philosophers and scholars of repute have published histories of Indian philosophy. The history of science is being pursued in more than one research institute and the National Commission for the History of Science has published a one-volume history of science, apart from texts and research monographs. The *Concise History* is perhaps the only one of its kind and, although it follows a number of more specialized works, it is a pioneering and ambitious work which has a vast sweep. It naturally suggests that much more needs to be done.

Of the many-volumed histories, one may mention here *Cultural Heritage of India* in six volumes published by the Rama Krishna Mission (originally published in three volumes in 1937). *The History and Culture of Indian People*, under the general editorship of Professor R.C. Majumdar published its first volume in 1951 and has gone into eleven volumes, several of which have been popular enough to have been reprinted many times. It was noted that 'this history, unlike its predecessors, is first and foremost a history of India and of her people rather than of those who have from time to time invaded her'. The *Times Literary Supplement* also noted that the history emphasized social and cultural rather than political aspects. Dr K.M. Munshi had hoped that 'modern historians of India must approach her as a living entity with a central continuous urge of which the apparent life is a mere expression'. This hope,

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however, can hardly be said to have been fully realized. Despite the well-deserved popularity of the first few volumes of the series, they retain, by and large, the older philological and political focus. Although they add archaeological material they present scanty data on science and technology, creative literature and philosophy. A different group of historians belonging to the Indian History Congress has been publishing very tardily the *Comprehensive History of India* planned in twelve volumes where the emphasis is on archaeology or political and socio-economic history. Archaeological and anthropological researches, however, have consistently outstripped the compilations of general history. Like the volumes of the *Corpus Inscriptionum Indicarum*, the Project of the People of India of the Anthropological Survey of India has been attempting to compile a summary of the evidence.

Professor Radhakrishnan's *History of Indian Philosophy* is perhaps the best known as well as the most brilliantly written of the histories of Indian philosophy but it is not intended primarily as a work emphasizing historical or textual scholarship. Although the author's profound knowledge of comparative philosophy lights up the work, he is as a Vedāntin naturally free from the anti-metaphysical and dominantly linguistic-cum-logical concerns of recent western philosophers. Professor Das Gupta's five volumes of *History of Indian Philosophy* are based on a vast textual scholarship but keep away from comparative philosophy or contemporary philosophical idiom. Frauwallner's *History of Indian Philosophy* (English translation, of which two volumes were published) is based on wide-ranging scholarship but is preoccupied with speculative anthropological and historical issues rather than with philosophical or even textual ones. Potter's *Encyclopaedia* of which the seventh volume has been announced attempts summary translations of some important texts. Stcherbatsky's *Buddhist Logic* illustrates a penetrating combination of philosophical and textual study. Nakamura's *History of Vedānta* exemplifies an admirable combination of historical and textual scholarship. The present editor's *History of the Evolution of Buddhism* (in Hindi) makes an attempt to combine historical, textual and philosophical interpretation. E. Lamotte's *L'histoire du Bouddhisme* is primarily historical but detailed.[5] Apart from the task of representing the historical and logical aspects of philosophical ideas, there is also the task of relating the actual concepts and methodology of the texts with the concepts and methodology of representing them, especially in the context of translation or interpretation. The experimental diversity in this regard has a long history stretching from Cowell and G.N. Jha through Radhakrishnan and Hiryanna to Piatigorski and Zilbermann, K.C. Bhattacharya and Sibjiban Bhattacharya. Among classic achievements in translating the expounding difficult classical texts may be mentioned Gaṅgānātha Jhā's works on Mīmāṁsā and Hindu law; Phaṇibhūṣaṇa Tarkavāgīṣa's on old Nyāya; Cardona's, R.N. Sharma's and S.D. Joshi's ongoing works on Pāṇini; translations of Buddhist texts by La Vallée Poussin, Stcherbatsky and C.A.F. Rhys Davids; Thibaut's translation of Vedānta Sūtras, Paul Deussen's interpretation of the same.[6]

HISTORY OF SCIENCE AND TECHNOLOGY

Ancient scientific ideas need to be placed in their own perspective and brought into relationship with the social and ideological background of their times. Without this the history of ancient science would not shed much light on past culture, nor will its own meaning and dynamics become clear. It would remain simply a catalogue of results acceptable today and anticipated earlier. The conceptual, methodological and systematic aspects of old science as well as its social role would not be highlighted. The adumbration of this agenda is not to underplay the importance of valuable research work on the history of Indian science which has already been done. As far back as 1817, Colebrooke wrote the useful *Algebra with Arithmetic and Mensuration from the Sanskrit of Brahma Gupta and Bhāskara* (London). Thibaut and

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Sudhakar Dwivedi published and translated the *Pañcasiddhāntikā* in 1888.[7] Sankara Balkrishna Dikshita's *Indian Astronomy* in Marathi (1987) has been a classic. Kaye's *Hindu Astronomy* in 1924 presented a monographic survey of the subject. Datta and Singh's *Hindu Mathematics* (two vols., 1935, 1938) is another classic. Pingree's edition of Sphujidhvaja's *Yavanajātakam* is an important work. His essay on the History of Mathematical Astronomy presents a technical summary and comment in the light of the comparative history of astronomy. Pingree regrets the lack of theoretical interest and methodology in Indian works and is in this respect no different from many other earlier authors. It may be added that recent researches are discovering formulations of proofs in mediaeval texts. As for the stylistic peculiarity of giving results without proof, one may recall that even Rāmānujan, one of the greatest mathematicians of all times, has given many results without proofs. S.N. Sens's *Vijñāner Itihāsa* and *Bibliography of Sanskrit Works on Astronomy and Mathematics* exemplify narrative and research trends in the field.

In medicine, Th.A. Wise's *Commentary on the Hindu System of Medicine* (1945) and J. Jolly's *Medizin* (1901, English tr. 1951) were early modern expositions of āyurveda. Gananath Sen's *Pratyakṣa Śārīrakam* involved a major work of interpretation. The works of P.V. Sharma (*Āyurveda Kā Vaijñānika Itihāsa*, 1981; (ed.) *History of Medicine in India*, 1992), Attri Dev Shastri (1991) and G.N. Mukhopadhyay (1974) relate the history of āyurveda largely on traditional lines. Filliozat's *La Doctrine Classique de la Medicine Indienne Origines et ses Parallels Grecs* (1949) presents a different and comparative perspective. P.C. Ray's *History of Hindu Chemistry* (two vol., 1902) was a pioneering work. Satya Prakash's *Founders of Sciences in Ancient India* (1965) and *Vaijñānika Vikāsa Kī Bhārtīya Paramparā* (1954) are general historical accounts. B.N. Seal's *Positive Sciences of the Ancient Hindus* is a classic which discusses some basic concepts and theories. Such works, however, have been rare, though recently several projects with interest in theory have been taken up in various research bodies such as the NISTADS (National Institute of Science, Technology and Development Studies).[8]

HISTORIOGRAPHY OF ART AND CULTURE

The historiography of Indian art moved away from the era of Fergusson and Vincent Smith into that of Havell and Coomarswamy. V.S. Agarwal worthily furthered this tradition of relating art to cultural motifs and symbols. The attempt now is to interpret Indian art in the light of the concepts of the *Śilpaśāstra*. Such is the work of Dhaky, Saunderarajan and Krishnadev. In literature the many-volumed *History of Indian Literature* under the general editorship of Gonda largely concentrates on bibliographical information, summary description and accepted western opinions. A.K. Warder has attempted a *History of Sanskrit Literature* which would use Indian rather than Western concepts and norms but in the process these concepts tend to be insulated from the inevitable search for universality and the perspective of comparative literature.

The historiography of culture, however, is not limited to art and literature. Culture is the tradition of value-seeking, symbolically expressed in social consciousness. It includes not only the underlying vision and philosophy but also their myriad historical expressions, ranging from the mythical and ritual to science and technology. Cultural historiography needs to investigate to what extent the social forms constitute a *Zusammenhang* rooted in a Weltanschauung and, if possible, to bring out what has been called by Whitehead the 'form of the forms' of thought of a culture. Aurobindo's *Foundations of Indian Culture*, Gopinath Kaviraj's *Bhāratīya Sādhanā Aur Saṁskṛtī*, Radha Kamal Mukherji's *Culture and Art of India*, Radha Kumud's *Unity of India*, Radhakrishnan's *Hindu View of Life*, the present editor's *Foundations of Indian Culture*, Zimmer's *Philosophies of India*, illustrate such historiography in different ways, resulting from different perspectives of cultural historiography.

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HISTORIOGRAPHY OF INDIAN CIVILIZATION

The historiography of Indian civilization during the last two centuries has passed through many phases. On the one hand there has been a steadily growing access to source material, literary as well as archaeological; on the other, the weaving of evidence into narrative has inevitably been variable owing to the natural attempt of different schools of historical understanding and interpretation to monopolize it. Diverse philosophical and cultural points of view too have tended to produce quite different accounts utilizing more or less the same material. Broadly speaking, there are three distinct perspectives in the historiography of Indian civilization. These may be described as occidental, nationalist and Marxist. The occidental perspective found expression in colonial or neo-colonial or orientalist writings, 'old' and 'new', but is not exhausted by them. Except for its subtly continuing ethnic undertone, the Westernist approach is now largely indistinguishable from the modernist one and many Indian historians share in it as they did in the earlier historiography of even the orientalist or the colonial style. As orientalists, Western scholars examined the past of oriental civilizations as if from the vantage point of a superior civilization, nurtured on Christian ethics and Greek rationality. Modernism emphasizes scientific humanism, secularism and utilitarianism and attributes linear historical evolution to techno-scientific and economic progress as well as to the forces of democratic liberalism and egalitarianism. Most of these ideas are now universally accepted and hence the common feeling in the West that what has been achieved there in modern times is a pointer to the global future of mankind. Current historiography in the West consequently assumes that all civilizations are merely tributaries of the one civilization which is identifiable as modern-western. This fails to do justice to the concrete and persistent historical differences between civilizations and their axiological autonomy. While positive science, technology and economic goods have always tended to spread through the world from one society to another on account of their useful and objective character, the same is not the case with non-empirical values and beliefs which cannot be separated from socially inherited, subjective attitudes. Thus the current vogue of a universal civilization would appear to be partly misleading. The idea of a linear historical evolution is no more than an assumption which cannot be proved *within history*. It remains an ideological perspective belonging to the philosophy of history rather than to critical history itself. Historiography, however, cannot rest content with criticism, it has also to provide a narrative and here it cannot avoid philosophical assumptions. Were the simpler material orders of the early prehistoric ages idyllic or savage? May miracles in the testimony of witnesses be accepted as historical? Are religious movements determined by social or material conditions? How are great men related to movements? Must a powerful civilization be also called good? Does truth or the moral law prevail in history? Does the future augur well for mankind? Such questions do enter into the constructions of historical narratives and can only be resolved with the help of assumptions which go beyond historical evidence since they relate to the ways in which such evidence is to be assessed and used.

INDIAN SCHOOLS OF HISTORIOGRAPHY

Nationalist historiography has acted as a corrective to the one-sideness of colonial writing and has substituted the theme of national evolution for the chronicles of dynasties and war. At the same time sentiment, fuzziness, and the search for the 'objective spirit' or interpersonal unity of the nation gave to nationalist history an inevitably romantic aspect which could elevate or degrade it according to the quality of the historian. It needs to be remembered that the nationalist perspective was generally combined with modern rationalistic, liberal and egalitarian

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values, adding to these a romantic respect for past tradition and the solidarity of a fellowship in the pursuit of material and ideal values through the ages, a fellowship which is not reducible to any agreement of calculable interests. The sense of India as a holy land, of Indianness as a sacred tradition had existed from ancient times; so had the notion of India as an ideally unifiable political realm. The notion of the democratic state and a self-governing people gave the old cultural nationalism a new political form and the struggle for freedom helped make the new ideal a reality in the hearts of men. Many deities have been worshipped in India from time to time. This was the birth of the cult of Mother India and, in the words of Aurobindo, Bankim's *Vande Mātaram* was its veritable mantra.

Indian nationalism was not a narrow segregative enthnicism but the flowering of a tolerant synthesis of diversities. Numerous races, tribes and religions had made India their home and co-existed normally in peace. Castes, sects and cults similarly formed complex patterns of co-existence. This unity in diversity was recognized by the architects of India's freedom as the hallmark of Indian nationalism. The speeches and writings of Bankim and Tagore, Vivekanand and Aurobindo, Tilak and Gandhi, Annie Besant and Coomarswamy bring out this spirit of nationalism, at once distinctive and universal.

As is well known, national history has constituted one of the most important dimensions of historiography since the time of Ranke. This historiography of modern Western nations has, however, been structured basically as a political story. These nations could perhaps be described as politically independent linguistic provinces of a common European culture. India, on the other hand, has been a cultural continent. As a result, Indian nationalist historiography cannot but be the history of the common civilization of the Indian subcontinent aspiring to the ideal of a politically self-conscious people.

Marxist historiography treats politics and culture as superstructures or dependent variables, the determinant factors being the forces and relations of production. On this assumption, both nation and culture become superficial identities, the real identity being in terms of economic class. History itself becomes primarily not the story of the evolution of a nation or culture but the dialectic of the means of production and class relations. Thus Marxist historiography focuses attention on economic history, but all economic history need not be Marxist. Thus T.W. Rhys Davids and C.F. Rhys Davids had produced classic accounts of social and economic life from Buddhist sources, Dr G.S.P. Mishra studied the *Vinaya* for its social and economic data. Macdonell and Keith had presented the Vedic evidence. V.B. Rao and B.P. Roy have studied the later Vedic economy in the light of more recent evidence; Hopkins, in *The Social and Military Position of the Ruling Caste in Ancient India*, studied the epic evidence. Radha Kumud Mookerji's *History of Shipping and Maritime Activity* and R.C. Majumdar's *Corporate Life in Ancient India*, are old classics. Pran Nath, Rati Lal Mehta, N.C. Bandopadhyay, K.T. Shah, R.P. Kangle, J. Jolly, J.J. Meyer, B. Breloer, K.P. Jayaswal, Binoy Chandra Sen, A.N. Bose, A. Appadorai, B.N.S. Yadava, U.N. Roy, S.C. Bhattacharya, Lallanji Gopal, S.K. Maity, P. Niyogi, O.P. Yadav and others have attempted to reconstruct aspects of the socio-economic development of ancient India in the light of the Jātakas, the Arthaśāstra, the Smṛtis, epigraphic and other literary and archaeological evidence. The massive work of Kane on the Dharmaśāstras can be matched only by the *Dharmakośa* of Lakṣmaṇa Śāstrī. These are not Marxist accounts.[9]

From the Marxist point of view the most influential work has been D.D. Kosambi's *Culture and Civilization of Ancient India* which announced that history is to be understood as a series of changes in the modes of production. He views the Vedic Age as one of pastoral tribalism[10] and the Janapada Age as that of the breakdown of the tribes and the rise of Varṇa Society. The rise of Buddhism is attributed to the agriculturists' protest against the animal sacrifice of the Pastoral Age.[11] Mahāyāna is sought to be connected with the age of oceanic trade and the Gītā is said to reflect the confusion resulting from attempts at syncretism. R.S. Sharma's *History of*

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the Śūdras, Chanan's *Slavery in Ancient India* and V. Jha's writings on the Cāṇḍālas focus attention on the lowest social classes. R.S. Sharma's *Indian Feudalism* has inspired numerous attempts to understand the history of classical Indian society as one of feudalism. It has also been argued that the so-called Golden Age of the Guptas was really one of economic decline, which continued apace, leading to the decline of urban life, trade and money. Dr D.C. Sircar, Dr O.P. Yadav and others have rebutted such interpretations by critically examining the epigraphic evidence.

The most important and most widely influential aspect of the Marxist theory is the idea of economic causation. That economic conditions may help or hinder cultural phenomena would not be contested but economic determinism is hard to prove. In becoming a science, economic theory has become largely quantitative and its representation of economic reality is that of a structure of functionally related quantities. In econometric analysis we can see the coming together of what may be described as a tangent between economic history and quantitative economic science. As one proceeds beyond the functional relations and the actual values given in this tangent and considers historically variable psycho-social entities such as classes, values, knowledge, ideologies, interpersonal communication, creative symbols etc., one moves beyond the reach of quantitatively reducible or predictable factors and hence of establishing the economic causation of socio-cultural phenomena scientifically. The classical social theory of India recognizes the strength of economic as well as political forces but believes that, under a wise social dispensation, the two need not determine everything else. Man is not a mere *Homo economicus*, nor is economic behavior the sole, primary or ultimate determinant of human life which is a search for values (*puruṣārtha*) culminating in liberation. Non-acquisitiveness or non-possession is a value superior to the mere drive of instincts or interests. Much of Indian history has been determined by the force of these values at the relevant levels.

Most great civilizations evince their own characteristic philosophy of life and may be said to have a mission of their own in the overall history of mankind. As Mazzine said, 'Every people has its special mission, which will cooperate towards the general mission of Mankind' (*New Cambridge Modern History*, vol. X, p. 225). The great savants of India conceived the mission of Indian civilization to be the dissemination of the perennial spiritual law or *philosophia perennis*, not the exercise of political power or economic activity. However remote it may sound today, this dream has been cherished by the great leaders of India from the Vedic seers and the Śramaṇic sages to the medieval saints and modern savants.

OUR APPROACH

This is not to say that they could not have been mistaken or that we cannot think of other representatives of India. As far as the perspective of historical interpretation is concerned, this volume, like the series as a whole, subscribes to methodological pluralism. While it insists on the critical and rigorous examination of historical sources and the rule of evidencibility for all factual statements, it does not insist on any particular kind of interpretative perspective, orientalist or nationalist, liberal or Marxist, modernist or traditionalist. It does not believe that history as a story can ever be uniquely or finally told. What makes it open-ended is the inevitability of a philosophical perspective with which to estimate human nature or possibilities.

In terms of methodology in the broad sense, then, the present volume is historical, multidisciplinary and pluralistic. It is historical in a twofold sense. It is primarily based on the critical examination of the past records with respect to their date, authorship, reliability and significance, but it also seeks to weave the evidencible data so obtained into descriptive and narrative accounts. It is multidisciplinary in the sense that it does not reduce its subject matter

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simply to dateable public events as noted by observers or actor-observers but also seeks to represent critically the scientific, philosophical, and cultural ideas and values as they emerged in the historical course of Indian civilization. On the one hand, these ideas and values are the meanings received from the historical records and in this sense age-specific or part of a dateable social consciousness. On the other hand, the ideas and values seek to belong to a timeless world of logical or symbolic connections and need to be assessed in their own right. The meeting of the two dimensions of meaning and happening is characteristic of genuine cultural history.

The task of meaningfully combining the two aspects—factual-chronological and logical-axiological—is never easy and some consider it impossible or a confusion of categories. If that were really so there would be no history of science or philosophy except for catalogues of contradictory ideas belonging to different times and places. It is well known that the logic of such historiography has been diversely explained. The idealistic dialectic of Hegel and the Neo-Hegelians, the materialistic dialectic of Marx and the post-Marxists, the concept of absolute presuppositions or that of paradigm change are some examples. In the Indian tradition too this problem has been faced as that of giving meaning to contradictory philosophical ideas and systems. The concepts of *vāsanābheda, adhikārabheda, upādhibheda, prasthānabheda, naya-bheda* etc. are examples. Even the *Sarvadarśana Saṁgraha* seeks to arrange the systems in a logical order while disregarding the chronological historical sense. It is in the works of M.M. Gopinath Kaviraj that one can see the full-fledged synthesis of historical and textual scholarship with philosophical understanding. His selected essays in *Bhāratīya Saṁskṛtī Aur Sādhanā* (two vols.) show not only the interconnection of systems of philosophical ideas but also their background of spiritual culture. Another example of such work is K.C. Bhattacharya's essay on Sāṁkhya and yoga where textual knowledge and philosophical insight combine. At a different level, Stcherbatsky's *Buddhist Logic* combines historical description and philosophical interpretation. Tilak had, in his introduction to his *Gīta-rahasya,* distinguished between the external and internal critiques of a work. What is usually called the historical consideration of a work is this external critique, concerned with its date, authorship, affiliation in terms of system or school, influences or interaction with other works etc. The inner coherence, experiential or logical validity, axiological soundness, symbolic effectiveness, significant intermeshing with the relevant world of concepts, values and symbols etc. constitute the subjects of internal critique. These two cannot be brought together without interdisciplinary competence, although such competence in a scholar need not necessarily produce a profound historical work. Thus Hegel's *Lectures on the History of Philosophy,* despite its historical aberrations, remains a profound work while Bertrand Russell's *History of Western Philosophy* remains superficial except in parts, as for example where it deals with Leibnitz.

Philosophy only exemplifies clearly the more general problem of the historiography of culture where the determination of facts and the understanding of ideas and values have to proceed simultaneously though at different levels. The Upaniṣads, for example, need to be noted as the dialogues of priests and sages recording their opinion in a particular socio-ritual and intellectual context. They form a link in the chain of the development of Vedāntic thought. At the same time, they open a symbolic door to the perennial tradition of autological enquiry. Walter Ruben sees in the Upaniṣads a social conflict of the priests and the rulers. Professor Ranade analyses them on the model of pre-Socratic philosophy. Belvalker and Ranade subject them to an acute historical analysis which includes the texts as well as the ideas. It is in the writings of Coomarswamy or Śrī Kṛṣṇa Prem, however, that one may see the full spiritual symbolism of the Upaniṣadic meaning. Similarly, the profound meaning of the Vedic hymns, extending beyond ritual and prayer, may be seen in the works of Coomarswamy, Aurobindo, and their followers or, in a different sense, in Raimundo Panikkar or the Jaipur School of Madhusudan Ojha.

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Thus in the historiography of culture the records need to be examined not only as records of facts but also as communications of ideas and values. Textual and historical criticism of records needs to be joined to hermeneutic interpretation and the twofold dialectic, ideal as well as historical. This is hard to accomplish, especially when there is an overall deficiency in the record itself which makes the determination of its meaning, context and historical significance uncertain and speculative. This is one reason why the major questions arising out of the records of this period easily lead to speculative answers. The diversities of interpretative perspectives further vary the answers. In admitting this diversity, the present volume is pluralistic. There is no simple and final narrative nor any finally determinate set of explanations which would sum up any single period or periods of ancient Indian history. At the same time, it must be admitted, as new evidence is found and as greater agreement is reached about historical explanations in general, we are moving towards greater agreement than before and the present volume too seeks to further this progress. Thus the progress of protohistoric archaeology has virtually eliminated the hypothesis of a West Asiatic origin of the Harappan civilization. Similarly, changes in the concepts of race and language, coupled with new archaeological discoveries, have made the hypothesis of an invading Aryan race less credible than before. Both the Harappan and the Vedic evidence is being reviewed and reinterpreted now. The gulf between the Harappan and the historical period is being narrowed. New dimensions of Vedic interpretation are emerging. However, controversies, like prejudices, die hard, more particularly so if uncertainties loom large.

SOURCES OF INDIAN HISTORY

It is well known that the sources of ancient Indian history are conventionally divided into the literary and the archaeological. The literary sources include historical or semi-historical works, general literary works of any kind, and works of foreigners who had access to information about India. The first of these include Vedic and epic legendary accounts contained in the *ākhyānas, gāthā nārāśamsī, upākhyānas* and *itihāsa.* The *purāṇas* constituted an ancient literature of mixed priestly and bardic origins and dealt with cosmic as well as human history. *Sarga* (creation), *pratisarga* (dissolution), *vaṁśa* (priestly genealogies), *manvantaras* (cosmic ages) and *vaṁśānucarita* (royal genealogies), these were the subjects of history. It is common now to describe Purāṇic cosmology as mythical and Purāṇic genealogical traditions as legendary. The historical value of the Purāṇas was first clearly established by Pargiter. V.S. Agarwal has shed much light on Purāṇic myths while R.C. Hazra has examined their historical formation. It seems that while, in some form, the Purāṇic materials go back to the Vedic age, they received their present form in the Kuṣāṇa and Gupta ages after which they gradually came to acquire a sectarian character. They continued to proliferate even after this and a class of *sthala-purāṇas* came into existence.

The Purāṇic traditions go back to the Vedic age and come down to the early medieval period. Their genealogies doubtless contain repetition, conflation and inflation; their legends are not free from mythical elements and bardic exaggerations; nevertheless, they contain not only a kernel of reliability but a skeletal history which has been camouflaged by the palimpsest of passing ages. The Purāṇas remain, after the Vedas, the most ancient literary source for the history of ancient India and the most encyclopaedic for its culture. But they stand in need of much more critical research, which is now being attempted by S.N. Roy, Vidya Nivas Misra and others.

Thus, Purāṇic genealogies and chronology have to be cautiously used for the period in which they can be checked with the help of other, independent evidence, especially the evidence of epigraphs. As for the genealogy of the earlier period, it has been generally treated

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with skepticism or even indifference. That these lists should derive from an ancient tradition appears possible, but it cannot be ascertained how much of the ancient tradition is preserved intact and uncorrupted. The lists begin with the first mythical ruler, Manu Svāyambhuva. From there the lists go on to Manu Vaivasvata in whose time the flood occurred. From Manu Vaivasvata to the Bhārata war 95 generations are stated to have passed. Between Parikṣit and Mahāpadma Nanda 1050 or 1015 years are said to have elapsed.[12] This would place the Bhārata war in the fourteenth century BC, which is not implausible. This does not mean that we know anything definite about the nature of the war[13] except that it was held to have marked a turning-point in the history of civilization. This contradicts the later tradition of the Kali age beginning after the war which was then calculated to have occurred in 3102 BC. It is, however, usually believed that the idea of the Kali era was invented some time in the Gupta age, prior to the sixth century AD. The purāṇas themselves mention the *Saptarṣi* era with a cycle of 2700 years.

Varāhamihira describes these eras: 'Now from Mahāpadmananda's coronation to Parikṣit's birth this interval is indeed known as 1050 years. The Great Bear was conjoined with the Maghās in Parikṣit's time a hundred years.' Alberuni discusses the Saptarṣi era in the light of traditions recorded in the *Viṣṇupurāṇa, Varāhamihira, Karaṇasūtras,* and the Kashmiri almanacs and shows their contradictions.

Itihāsa and Purāṇa were closely allied genres. The subject matter of the ancient Purāṇas has been mentioned above. Itihāsa had the sense of a traditionally handed-down story illustrating some principle. '*Itihāsa* furnishes empirical instances (*pratyakṣa paridṛśyamānāḥ*) of action and experience which are made known by tradition (*āgamīkārthāḥ karmaphalasambandhasvabhāvāḥ*).' Mahābhārata as the major itihāsa text is full of stories about heroes and characters figuring in ancient heroic legends. The stories are of little historical value but the name and fame of some of the heroes are known in Vedic and Purāṇic literature. Thus Devakīputra Kṛṣṇa figures in the *Chāndogya Upaniṣad.* Parikṣit is found in the *Atharvaveda Saṁhitā,* Janamejaya in the *gāthās* quoted in the Śatapatha. Śantanu is mentioned in the tenth *maṇḍala* of the Ṛgveda. The name Rāma occurs earlier in the same text and Janaka is a famous ruler in the *Bṛhadāraṇyaka.*[14] It would be seen that the present epics being *kāvya* as well as *itihāsa,* weave romantic stories around some famous legendary heroes. They illustrated dramatically the interplay between character, deeds and fate. At the same time, they possibly retain some memories of remote times and places, but these cannot be used in history without criticism and confirmation. The difficulties in dating these texts in whole or part make their use more difficult. These questions will be discussed in detail in the second part of the present volume.

Ākhyāyikās, Caritas and Prabandhas continue to extend the knowledge of historical traditions in classical times. Professors V.S. Pathak and A.K. Warder have produced valuable pioneering studies of this literature. Epigraphic evidence makes it easier to check its historical elements. Buddhist and Jain chronicles and the unique *Rājataraṅginī* are more consistently historical in character. The Buddhists have also produced a number of biographies which are known only through their translations. Professor A.K. Warder has argued that the traditional memory certainly needs to be used by the side of what modern critical history has reconstructed. Thus the stories of Udayana, Candragupta Maurya, Aśoka, Puṣyamitra, Hāla, Kaniṣka, Candragupta Vikramāditya, Harṣavardhana, Bhoja, Prithivirāja Cauhāna etc. focus attention on the heroes found in tradition which preserves little memory of invaders like Alexander. The legendary and literary biographies of saints and prophets like Buddha or Śaṅkara may also be recalled here. This is, of course, not to say that legendary stories are to be admitted into history, but they are valuable as folk history, showing what the people tended to believe about the past as worthy of remembrance or contemplation. These traditions provide as much a theme for critical history as a source for it.

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Foreigners' accounts, especially travelogues, are important not only for the knowledge of conditions which could be observed or the traditions which could be gathered by them but also as examples of comparative cultural comments. The classical accounts from the West have been much analysed and researched, but the accounts available in diverse Asian languages—West Asian, Central Asian, Far Eastern and South-East Asian—have not been exhaustively researched or translated. Even such well-known records as those of Hsüan Chwang or Alberuni would bear fresh translation and explanations. The recent new edition (1990) of Hsüan Chwang's *Si-Yu-Ki* from Beijing is an example.

SOURCES OF CULTURAL HISTORY

The major sources of Indian cultural history, however, are constituted by the general and technical literature of the age. V.S. Agrawal's use of Pāṇini's *Aṣṭādhyāyī* or Bāṇa's *Harṣacarita* constitute classical models of such work. B.N.S. Yadava has recently shown how astrological and lexicographical works may be used in the reconstruction of social history. The *Vedic Index* has long been a classic but the new concordance published from Hoshiarpur suggests that it could be critically revised. Similar concordances for epic and Purāṇic literature are still a desideratum. Although the epics have at last been critically edited, for the Purāṇas this task has only now been systematically commenced by the Kasiraj Trust. The definitive edition of the Pālī canon as determined by the last Burmese synod, along with the commentaries, is now being published in Devanāgarī by the Vipassana Research Institute, Igatpuri. The most ambitious task of the restoration of some parts of the Tibetan canon has been taken up by the Central Institute of Higher Tibetan Studies, Sarnath, but is naturally making slow progress. On the other hand, the publication of rare manuscripts by the Institute is proceeding rapidly. Researches into the philosophical *Śāstra* texts in the Chinese canon have not received much attention in India. Even the work of researching texts or producing annotated translations promoted by Waldschmidt, La Valle Poussin and E. Lamotte and others appears to have slowed down. Comparative studies of the *Āgamas* attempted by scholars like Takakusu or Akanuma need to reach much more depth and reach. Nakamura's works like *Ways of Thinking of the Eastern Peoples* or *Indian Buddhism—A Survey with Bibliographical Notes* or *History of Vedānta* illustrate the kind of incisive and yet extensive study which is needed for the full utilization of the Chinese material, just as Stcherbatsky's works set a model for the investigation of Tibetan philosophical texts. Even the critical historical study of the Pālī sources has not received continuous attention, despite some pioneering work.[15] Despite extensive, philological researches on the Vedas for more than a century, the *understanding* of the Vedas has still to go a long way.[16]

Archaeology undoubtedly constitutes not only the most important source for the material and social history of ancient India but is also the sole source for the long ages of prehistory. Prehistoric archaeology today is a complex and growing science which reveals the material traces of early man in successive temporal strata. Thanks to the Archaeological Survey of India (ASI) and some other centres and research projects, this record has been growing so fast that its full interpretation and integration have not kept pace with it. While the multidimensional methodology of archaeological research is constantly unearthing new data, such as is exemplified by the satellite surveying of the lost Sarasvatī or the discovery of ancient Dwārikā by under-water archaeology, the interpretative models cannot be said to be adequate for any profound conception of culture. Archaeological reconstruction of prehistoric culture has tended to follow, in its general conception of primitive mind and society, the light of anthropology, especially in the New World. Gordon Childe's archaeological model of primitive man and society has given the anthropology of Morgan wide popularity.[17] This

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conception of primitive culture assumes that the advancement of the human mind and character depends on the advancement of material conditions, i.e., on man's capacity for controlling the environment through scientific knowledge and technology and using it for the satisfaction of human wants. In other words, it identifies human culture with human civilization. Now the reconstruction of the vicissitudes of human civilization through archaeological research is certainly a worthy historical task and is part of what is envisaged in this volume. Nevertheless, it should not be taken to mean the rejection of the traditional view that the material simplicity of primeval man was not only consistent with but even conducive to a state of simple moral and spiritual culture, a view which has received support from some modern anthropologists such as Father Schimidt of the Kulturkreise School. Doubtless this has been stoutly opposed too and a virtually Hobbesian view of primitive life as 'nasty, brutish and short' has been advocated; primitive morality has been reduced to kinship conventions, primitive spirituality to animistic superstition, primitive wisdom to mythical fantasy. Such a view forgets that most of the major forms of social and cultural life, such as family, clan, state, tool-making, language, art and religion, owe their origin to prehistoric man. The memory of spiritual life in the forest has been permanently enshrined in the Indian tradition.[18]

There are two implications of this. One is that although the archaeologist is prone to concentrate on the development of the material traces which are his evidence, it should not be concluded that the pre-literate Stone Age culture of man was simply savage or barbaric and did not include culture as the pursuit of higher values. The very existence of familial social solidarity, technological traditions and, at least from the Upper Palaeolithic Age presumably, of symbolical activity as reflected in painting and burial is evidence of higher culture. Language presumably is as old as man because no social tradition is conceivable without it. This higher life expressed in myth, ritual, art, language and custom has not been totally interrupted by changing modes of material production and social life, although they have necessitated adaptations in symbolism. Another implication is that the rich heritage of prehistoric paintings in India needs to be studied with greater attention as the visible speech of those times which has continued in later ages along with tribal life itself. A sense of some continuity in the handicrafts, social customs and symbolic cultural traditions of India from Neolithic-Chalcolithic times may be not unreasonably premised.

PERIODIZATION

Periodization and chronology constitute difficult problems for anyone who sets out to represent the cavalcade of ancient Indian history. For a long time Indian history has been divided according to conquests and dynasties but these divisions do not necessarily correspond to any profound changes. As Nehru has remarked of India, 'She was like some ancient palimpsest on which layer upon layer of thought and reverie had been inscribed and yet no succeeding layer had completely hidden or erased what had been written previously'. (*Discovery of India*, p. 47) This is in contrast to western history

> which can be arranged in a clear succession of epochs where from time to time, sharp far-reaching changes occur so that the continuity of the whole is more causal-historical than traditional-ideal. In contrast Indian history exhibits no clear-cut successions but rather the continuation of many strands and levels where emphasis shifts in a kaleidoscopic manner. The old survives with the new, which in any case emerges tentatively and slowly. Heterogeneity and contradictions remain rife but are also sought to be reconciled even syncretically. Old texts and traditions are strenuously maintained but silently remodeled through interpretations and interpolations. Instead of being a succession of epochs,

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Indian culture looks like an 'ancient palimpsest' (*An Approach to Indian Culture and Civilization*, p. 45).

While the memory of the past is preserved through history, the past itself is dynamically preserved by tradition. A living tradition of *sādhana* or *yoga* as the praxis of *philosophia perennis* constitutes the inner life-force, the *natura naturans*, of Indian culture. The manifest social or symbolic order, *dharma* and *śāstra*, show an age-specific character. The concept of the age or *yuga* was traditionally defined by the virtue, moral ideals and institutions of the people. In the early post-Vedic age, the idea of the four ages or yugas had emerged and finds mention in the epics, the sūtras and purāṇas.[19] With each successive age virtue is supposed to have declined by one quarter so that in the present Kali age only a quarter of dharma survives. It may be recalled that the idea of an original age of virtue is to be found in the Buddhist and Jain traditions also. Indeed, the idea is found in other ancient civilizations also. The earliest or Kṛta age was one of simplicity and spontaneous truth where mankind lived by virtue alone and the Vedas were undivided. The Tretā saw the three-fold division of the Vedas and the introduction of complex ritualism, the Dvāpara was marked by the degeneration and internal strife of the ruling Kṣatriya dynasties, ending in the holocaust of the Mahābhārata war which ushered in the Kali age which continues today and of which the characteristic evils are recounted in detail in many texts. According to the *Manu Smṛti* the duration of the four ages is 12000 years, of which 1000 plus 200 belong to Kali. Traditionally, these years are supposed to be 'divine' rather than human so that the duration of Kali yuga could be 4,32,000 years. One is tempted to speculate that originally the concept of the Kali age arose as that of a millennium of decline following the havoc of the great war. In the classical age the concept of the Mahāyuga was remodeled as an astronomical idea.[20]

The history and meaning of the four ages are not wholly clear but there is no doubt that the great war which is taken as a watershed and this basic distinction between the sense of present decline and past order became the basis of the concept of the Ages. Today, the common scheme of periodization dates this watershed at the end of the Vedic age. Unfortunately, neither the beginning nor the end of the Vedic age can be clearly determined.

It has generally been supposed that the Harappan age preceded the Vedic and the Mahājanapada age succeeded it. This would give a sequence of rising Chalcolithic urbanism over the third millennium BC and of urban decline with the emerging Iron Age in the second millennium followed by a second urban revolution in the last. While this sequence has an archaeological meaning, its correlation with cultural ages remains uncertain. The relationship of the Harappan to the Vedic is undecided although it is more or less certain that they at least partly overlap in time and space. This assumes that the hypothesis of the non-Vedic Aryans in India has no meaning. The Vedic age extends over both the Chalcolithic and the Iron Ages and its degree of urbanism too is undecided. How exactly Vedic and non-Vedic cultures were related is not clearly known but there is no doubt that the two gradually fused in the post-Vedic age to form the classical culture of India.

DATING INDIAN HISTORY

Since the equation of Sandrokottus and Candragupta Maurya, the date of Alexender's invasion has been the sheet anchor of ancient Indian chronology. For the earlier period, it is difficult to confirm any definite date, which is in sharp contrast to ancient West Asian or Egyptian history. The date of Buddha's *parinirvāṇa* has been traditionally fixed at 544 BC but modern historians had more or less reached a consensus that it should be placed in the fifth century, in 486 BC or 483 BC. Recently, however, this date has been challenged at the Gottingen Colloquium and a date in the fourth century BC has been suggested. It has been argued by

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Bechert, its leading spirit, that Indian literary tradition cannot be relied upon in such questions since it lacked all sense of chronology and that, consequently, we must turn to the archaeology of Buddhist sites to determine the probable date of Buddhist literary descriptions. Archaeological evidence, however, does not really support any such conclusion, as was convincingly argued recently in a National Seminar held on the subject at the Allahabad Museum. Nor is it objectively true that the ancient Indian historical traditions—Purāṇic, Buddhist and Jain—are devoid of any sense of chronology.[21]

Apart from the date of Buddha's *Parinirvāṇa*, the date of Pāṇini in *c.* 500 BC is also generally acceptable. Yāska is earlier than Pāṇini and presupposes a vast development of Vedic literature. Devakīputra Kṛṣṇa, Parikṣit and Janamejaya would, as stated before, belong to the later Vedic period. The dates of some Vedic texts have also been proposed on the basis of astronomical data. On account of ritual requirements the Vedic priests noted the identity of the *nakṣatras* in conjunction with which the sun arose due east on the day of the spring equinox. Similarly the star conjunction was noted when the course of the sun turned southwards or northwards, considering the role of the precession of equinoxes. These observations yield more or less definite dates.[22] These dates and the validity of such dating are discussed below.

What distinguishes early Indian chronology from that of West Asian or ancient Egyptian civilization, is the absence of royal epigraphs in India dating before Aśoka. Even so, the relative chronology of literary texts and archaeological finds can be made out approximately. Where the literary and archaeological data can be correlated, determination of chronology can be done more definitely.

The time span of this part of the present volume, comes down from the earliest times to the first half of the first millennium BC, though it treats the Stone Age only in brief outline since it was not intended to present those numberless details which archaeology has unearthed but which cannot yet be woven into a significant narrative tapestry. Similarly, the purely linguistic, literary and ritualistic details of the Vedic corpus are also presented in broad outline only, in view of the already burgeoning size of the volume. One part of the focus in the volume is on the emergence of civilization and its assumption of a characteristic Indian aspect. The other part of the focus is on the growth of scientific knowledge, technological capacity and philosophical reflections.

While the emergence of the first civilization in India may now be dated in the Chalcolithic Age, between the fourth millennium BC and the middle of the second millennium BC, the succeeding millennium of the emerging Iron Age saw a gradual but increasingly discernible general change which gave rise to the notion of the Kali age.[23]

INDIA IN THIS VOLUME

Turning to the space to which this time and its events belong, it is necessary to be clear about the meaning of the term 'India' in this context and also about the role of its geography in the shaping of its history. In the historical context India signifies the whole South Asian subcontinent, extending from the Himalayas to the sea. In the north-west the space of Indian history at one time extended up to the Hindukuśa and beyond, i.e., to Gandhāra, Bahlika and Kamboja though in this region a conflict and mingling of Indian and Iranian or Central Asian elements could often be seen. The determination of such historically variable cultural boundaries naturally cannot be determined with such precision as political or military frontiers. In the north-west such frontiers could be ascertained with the help of language, most clearly. The evidence of Vedic literature, Pāṇini, the inscriptions of Aśoka, the monuments of Buddhist art and monasteries, the Janapada lists in the epics and the Purāṇas

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attest to the presence of Indian culture far into the northwest in ancient times. But India here does not mean the present-day Indian Republic, nor does 'Indian culture' in this context have any ethnic connotation. What constituted the 'Indian-ness' of this culture in the far north-west was not identifiable ethnically, nor even in terms of the typical *caturvarṇya* structure of classical India. It was essentially an identity in terms of language, religious movements and art, apart from the operation of political and military forces from time to time.[24]

The traditional geography of India is to be found in the epic lists of territories, states and people; the *Bhuvana-kośa* lists of the Purāṇas and in works like the *Bṛhatsaṁhitā* of Varāhamihira; and Buddhist and Jain works which also contain similar lists. Jambudvīpa, Bhāratvarṣa and Kumārīdvīpa were the traditional appellations of the subcontinent called India by the Greeks originally. This continent, with its mountains and rivers, was divided into many territorial settlements or Janapadas. Traditionally, in Hindu ritual one recalled ones location in space in terms of the Jambudvīpa and Bhārata Khaṇḍa, not just in terms of immediate territorial settlements of Janapadas. The *dharma* or social-cultural ethos which one professed was also defined with reference to the continental Indian identity which was geo-cultural, not merely territorial.[25] The space of Indian cultural geography was much wider than that of actual political territories, though as an ideal it was held that it was the proper sphere of a Universal Sovereign (*cakravartī-kṣetra*). It is interesting to observe that when Indian cultural traditions were carried to distant lands in south-east Asia an attempt was made there to duplicate the 'Indian' universe within the space of the region.

Since the time of Macaulay the Purāṇic geography of the *dvīpas* and the oceans of milk and sugarcane juice has been ridiculed by many but its real meaning has been brought out by scholars like Professors S.M. Ali and V.S. Agarwal. The *dvīpas* are not islands but continents or *Iqlim* and the ocean of *Kṣīra, Ikṣu* etc. were so called on account of their appearance. On the other hand, the mythical descriptions in Purāṇic geography have a symbolic aspect. In mapping the earth its centre was conceived as Meru or Sumeru. In ancient Vedic thought the highest heaven (*parama vyoman*) was conceived as the fixed centre, contrasted with the moving worlds below. To this corresponded the astronomical north pole or Sumeru round which the luminaries move. The geographers imagined a fixed point of centre for the earth with reference to which may be located the continents. This centre was called the Sumeru or Meru and the continents were in different texts counted as four, corresponding to the four quarters, or as seven in consonance with the ancient Vedic scheme of the sevenfold division of space. V.S. Agrawal believed that the conception of the seven continents was developed out of the earlier conception of four continents.

The most realistic and useful part of traditional geography remains its description of the mountains, rivers and Janapadas of Jambudvīpa. These Janapadas are grouped in broad regions in several ways.[26] One way was to conceive of these as five corresponding to the four quarters and the middle of these, Varāhamihira has a nine-fold division. The north was Udicya, the north-west Uttarāpatha, the east Prācya, the south Dakṣiṇāpatha, the west Aparānta, the north as a whole Āryavarta. The broad central regions, the original heartland, was Madhyadeśa, the tribal area Parvatāśrayinaḥ or Ātavikaḥ. A meaningful contrast was between Madhyadeśa and Pratyanta, a contrast which is substantially present in the inscription of Aśoka. This may be compared with the contrast which Spate has effected between 'nuclear' and 'refuge' areas and their differential roles in history.[27]

The emergence of civilization in India occurred in the region from Brahmavarta to Aparānta, Sindhu-Sauvīra, Pātāla, Gandhāra, Bahlika and Kamboja. Broadly this was the region of Uttarāpatha and Aparānta in the emergent Chalcolithic phase as the Madhyadeśa was in the later Vedic or Iron Age phase. The homeland of the succeeding classical civilization spread from Madhyadeśa to different provinces of the whole country. There has been a familiar idea that this cultural expansion followed the highway of the invading 'Aryans' from

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the north-west towards the east and the south, i.e., along the northern highway and the southern highway (Dakṣiṇa Patha). The hypothesis of the Aryan invasion is, however, difficult to substantiate by firm identification based on archaeological evidence. The spatial and temporal expansion of archaeologically evidenced cultures is hardly consistent with the hypothesis of the spread of culture to the east and the south in the late centuries of the first millennium before Christ.

GEOGRAPHY AND CULTURE

Many attempts have been made to connect geographical factors with cultural formations. Thus the prevailing climate of India has been blamed for its enervating influence, but this role of climate is not the same at different levels of man's adaptive and technological capability. The same is true of natural resources. Geography presents a matrix of challenges and possibilities. How these affect society depends on the way in which they are met and used. More generally, in thinking of the material basis of culture we ought to think not so much of natural conditions as of their utilization in terms of its techno-economic capacity. The geo-cultural complex is thus an interactive unity of man and nature, of particular importance here is the attitude of man towards nature. In the Vedic age it was worshipful rather than exploitative. Nature was considered the manifestation of the gods. In course of time, the Purāṇas came to view the whole country as holy, dotted with *tīrthas* all over.

ARCHAEOLOGY AND HISTORY

Prehistoric archaeology studies the material remains of early man but the reconstruction of prehistoric life or society requires not only the integration of artifactual with ecological studies but is possible only with the help of what has been called ethnographic parallels. Tools and settlements have to be studied holistically, in the light of the evidence of geomorphology, palaeobotany, palaeoclimatology, palaeozoology etc. On the other hand, even the implicit use of ethnological parallels needs to be critical. In general, such parallels can be established only by assuming what has to be proved, viz. that under parallel technological conditions parallel social institutions and cultural forms would arise. It needs to be remembered that, if prehistoric archaeology pictures man as *Homo faber*, it must not blind one to the complexity of human nature and actions. Man, for example, was also *Homo ludens*, just as he was a thinker or worshipper. Nor was his making simply tool-making. Thus the Vedic *karu* or 'maker' was not only the tool maker but also the priest who made prayers. Priestly ritual and incantation pervaded all activity where the sacred and the profane, the psychic and the physical were not separated. The utilitarian, the aesthetic and the religious dimensions of making and doing were linked together in the earliest civilization and this tradition presumably goes back to earlier times. The later work of Lewis Mumford is significant in this context.[28]

While the study of tool types, their technology and affiliation has been carried on assiduously, culminating in the *magnum opus* of Sankalia, environmental studies leave much to be desired. T. de Terra and T.T. Paterson's *Studies in the Ice Age in India and Associated Human Culture* (1939) has been a classic and is still reliable in parts. The review of some of its results was initiated by the British Archaeological Mission to Pakistan in 1983. The work of Rendell, Hailwood and Dennel in 1987 and 1988 has added important new results which also affect the dating of tools. Significant environmental studies of some other regions and ages have been brought out such as those about the Thar and arid zone in the late Pleistocene or of some of the river valleys such as the Son or the Belan. Since such work so far covers the space-time of

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the Stone Age in India in parts only, a holistic account of the age is not yet possible. Nevertheless it does provide a broad ecological outline of the age for several areas and at the same time provides a chronological framework. Thus in the area of the chopper/chopping complex the lower Palaeolithic goes down to two million years BP. The Acheulean hand-axe culture is also datable from 1.4 million years BP to 0.7 million years BP. The Middle Palaeolithic has given dates between 0.15 million years to 0.04 million years. The Upper Palaeolithic comes up to the beginning of the Holocene, when the Microlithic supervenes at many places, yielding in time to the Neolithic, which begins in the north-west *c.* 7000 BC, in the north *c.* 2800 BC, in the Vindhya regions *c.* 4000 BC and in the Deccan *c.* 2500 BC

Prehistoric archaeology by and large confirms the existence of the Early Stone Age man in India from at least two million years BP and has similarity to the rest of humanity with respect to the use of tools and, presumably, a simple mode of life dependent on hunting and gathering for immediate use. As the Stone Age progressed, sophistication and cultural variation also increased. When and how the domestication of animals and the cultivation of crops began in different areas in the Neolithic is still an open-ended story. That the cultivation of wheat and barley began for the first time in India in the Neolithic of the north-west appears clear but it is generally believed to owe its origin to import from West Asia, not to independent discovery. The cultivation of rice and cotton appears to have been indigenous but here too its beginning or original provenance are not wholly certain.[29] Nor is much known about the racial stock of prehistoric men in India except for some places and epochs, though the racial composition of the Indian population appears to have been more or less stable since Harappan times.[30]

Of human life in the Early Stone Age, it may be presumed that it was lived in small bands in temporary camps or shelters. Tool-making and hunting suggest the existence of social tradition and organization of which the actual forms are unknown. The Middle Palaeolithic with its more varied and sophisticated tools must have seen larger and more specialized social groups. The Upper Palaeolithic attests to the spread of rock art and burial, and presumably of many kinds of religious worship. The rock art gives us a most vivid insight into the mind and life of Late Stone Age man.[31]

With its ground and polished tools, domestication of cattle, settled habitation, surplus food production, storage and exchange, social differentiation, aesthetic creativity and religious activity, the Neolithic Age is the antechamber to the emergence of civilization. Evolutionism and diffusionism have long been debated points of view on the birth of civilization of which the latter has attracted many archaeologists in the Indian context. The discovery of the Neolithic at Meharhgarh as far back as *c.* 7000 BC and, recently, of the Chalcolithic Pre-Harappan-Early Harappan in the fourth millennium BC ought to set at rest the controversy about the origin of the Harappan civilization in India. Since the days of Marshall's monumental *Mohanjodaro and Indus Civilization* (1931) to Wheeler's *Indus Civilization* (3rd ed. 1968), the obviously Indian character of the civilization was recognized but, at the same time, its appearance of having grown up without any gradual evolution from earlier stages led to the hypothesis of the import of at least the idea of urban life and civilization from the west, just as its sudden destruction appeared to suggest that the invading Aryans of the second millennium BC ought to be held responsible for the event. Continuing research, however, has revealed wide-ranging antecedents in space and time of the Indus civilization. Thus reports of excavations from Amri (1964), Kotdiji (1965), Rahman Dheri (1982), and Tarakai Qila (1979, 1981) or from Kali Bangan (1961, 1962), Lothal (1973), Mitathala (1975), Surkotda (1971, 1972), Dvarka or Dholavira, have gradually but completely altered the perspective on the origins of the civilization. Among recent monographic discussions could be mentioned M.R. Mughal, *The Early Harappan Period in Greater Indus Valley* (1976); W.A. Fairservis, *The Roots of Ancient India* (1971); G.L. Possehl (ed.), *Harappan Civilization, A*

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Contemporary Perspective (1982); B. and R. Allchin, *The Rise of Civilization in India and Pakistan* (1984); Bhagwan Singh, *Vedic Harappans*; and the latest works of S.P. Gupta, *Sarasvatī-Indus Civilization* (1996) and B.B. Lal's, *The Earliest Civilization of South Asia* (1997).

The discussions about the emergence of the Indus civilization have been concerned with the problem of tracing the stages through which the civilization developed out of earlier Neolithic communities and the extent to which its contacts with near-eastern civilizations influenced it. Just as the development of Stone Age culture is conceived, even in the holistic approach, simply as a cumulative function or environment-cum-tool technology, i.e., as a self-sustaining process of material transformation where better tools lead to more effective and large-scale hunting, gathering and production, its surplus leading to exchange, specialization and social differentiation, similarly, the birth of a civilization is conceived as the more rapid transformation of societies through the changes in material conditions brought by a revolution in technological capability. This approach does not do justice to the nature of human civilization which is held together ultimately by moral, not material forces. Social, political and religious forms rest, not on the technology of production but on the prevailing Weltanschauung which synthesizes knowledge, values and interests into ideas which define identities, roles and goals and thus organize the norms of individual and collective behaviour. For example, the ancient Egyptian civilization arose with the idea of the Pharaoh as God on earth. In the ancient West-Asian civilization, the king was the priestly servitor of the god. All over, the Near East, the state and religion, kingship and priesthood were closely coordinated.[32] The functionaries of this sacred state administered affairs, regulated economic life, scanned the heavens, kept written records and promoted monumental arts. If the Greek civilization chose a different path, it was not on account of any discontinuity in technological capability but on account of a difference in ideas—religious and philosophical, scientific and political. Material conditions such as tools, raw materials, goods produced, means of transport, trade and settlement undoubtedly played an important role as facilitating and limiting factors in the emerging civilization but they could not be regarded as the determining or directing causes of the characteristic forms and values of the civilization.

It does not, therefore, appear convincing to seek to explain the rise and decline of the Indus civilization by the rise and decline of oceanic trade.[33] Rather, such changes in trade ought to be traced to the expansion and contraction of social vitality arising from its intellectual, moral and spiritual resources. Nor can climatic and accidental factors be anything more than challenges to be met by creative response. It is obvious, thus, that the observable rise and decline, the vicissitudes of Indus civilization would remain a mystery so long as we cannot understand its beliefs and values, the consciousness animating its material body. Even Wheeler distinguishes the material body of the Indus civilization from its spiritual legacy. The key to such an insight obviously lies in the deciphering of Indus writing.

The definitive identification of the Indus civilization itself depends on the deciphering of its script. Neither the Dravidian hypothesis adopted by the Finnish and Russian scholars and some Indian scholars, nor the much less favoured Sanskrit hypothesis adopted by some others, has met with universal acceptance. What is known of the Dravidian languages is far removed in space and time from the Indus civilization. Sanskrit, on the other hand, most likely belongs to the same or proximate space-time of the Indus civilization.[34] In either case, however, definitive decipherment must await bilingual inscriptions or much longer and more numerous inscriptions than are available upto date.

The relationship of the Harappan to the Vedic civilization has been a standing puzzle. At first it was seen as a case of obvious difference. The Aryans were supposed to have entered India in the late second millennium BC as a non-urban society with horses, speaking the Sanskrit language and worshipping iconic gods. The Harappan civilization was by then in manifest decline and had been a millennium earlier an urban civilization without horses but

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with apparently iconic worship. It knew writing while the Vedic Aryans did not for a long time. Most of these arguments have now been disputed. The very concept of race has undergone a sea-change.[35] It has been shown that the physical types in Punjab now are the same as in Harappan times. The picture of the Aryans as drawn by Schrader and Gordon Childe has been questioned. The ur-Aryan is only a construct and its vocabulary uncertain especially in its semantics.[36] This makes the task of determining the original culture and homeland of the Aryans on the basis of linguistic palaeontology an uncertain matter, in seeking to identify a pre-literate culture as Aryan, the archaeologist is left with only two diagnostic traits, viz. Chalcolithism and equine traces. On this basis some early sites in South Russia and Central Asia have been sought to be identified as early Aryan sites.[37] However, Chalcolithic features are not enough to identify the Aryans. Whether the horse can be regarded as a definitive identification or *sine qua non* of the Aryans at all places and times and whether Harappans were ignorant of the horse, are also not wholly certain.[38] Thus, in Renfrew's analysis, the Aryans seem to lose their ethnic and cultural identity and become a people who helped the spread of Chalcolithic farming culture in Europe. If we reflect over the fact that the Vedic people belong to the same or contiguous space-time of the Harappans and are also a Chalcolithic society, the similarity between them would be seen to be striking. Their spatial overlap or contiguity is most clearly seen in the role of the Sarasvatī region in both. The dating of Vedic literature in the Harappan time span is most clearly seen by astronomical evidence which has been revived since the days of Tilak and Jacobi. The presence of the horse in the Harappan space appears to have been now attested archaeologically at several places such as Surkotada.[39] Traces of a sacrificial religion are attested from several Harappan sites such as Kalibangan. That the Vedic people were illiterate or that they were ignorant of urban life have both been disputed. That Vedic interpretation is not free from ambiguity and uncertainty and is to a considerable extent dependent on the historical hypothesis assumed or regarded as credible by the interpreter, makes the task of relating Harappan and Vedic civilizations also uncertain. Nevertheless, there is no doubt that recent records tend to favour their close relationship. The distinguished contributors in this volume thus have agreed to differ on the exact nature of this relationship.

Despite the uncertainties of Vedic interpretation it has not been disputed that Vedic literature and its contents constitute the most ancient ideal foundations of Indian culture. That Indian culture has been formed by an interaction and growing synthesis of two streams, Vedic and non-Vedic, Aryan and non-Aryan, Brāhmaṇa and Śramaṇa, Brāhmaṇa and Kṣatriya, has been variably formulated by different scholars. In every case, it is Vedic literature that gives us the earliest evidence for all such formulations. That it is the Vedic vision of Truth and Right (*Satya and Ṛta*) which has been tenaciously held in Indian culture through all its vicissitudes as the essence of past tradition, is surely not a fact to be neglected by the historian. Ephemeral structures of wealth and power have not been celebrated in the Indian tradition except only as infrastructures for the establishment of a moral order (*dharma*). This continuity of ideas and emphasis on them is a characteristic feature of Indian culture so far as literary evidence goes. It is a welcome fact that interest in not only Vedic language, literature and religion, but also in Vedic philosophy and science has been revived in recent times. Indeed, the whole conception of the Vedic age has been changing as it has been placed in the perspective of a developed civilization with involvement in maritime adventure and astronomical exploration, much of which has been expressed in ritual symbolism.

NOTES

1. The views expressed by the editor do not necessarily represent the views of the contributors to the volume. On debatable issues of interpretation the different contributors have been free to express their different opinions.

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2. James Mill, *The History of British India*, 5th edn., vol. I, pp. xii-xiii. His son J.S. Mill thought that his views on liberty and representative government could not apply to India as an inferior civilization or race. Cf. Said, *Orientalism* (1955), p. 14.
3. Edward Said, *Orientalism*, p. 211.
4. Cf. Eric Stokes, *The English Utilitarians and India* (1959).
5. These titles merely illustrate some *approaches* to the *history* of philosophy. It is not suggested that they are the only or the most important titles in the field.
6. These names are also merely illustrative.
7. So Burgess (tr.), *Sūryasiddhānta* (1860), M.P. Srivastava's *Vijñāna-bhāṣya* (1940).
8. For example, N.G. Dongre, *Physics in Ancient India*, 1994, Wiley Eastern Ltd.
9. These titles merely illustrate some approaches to socio-economic history. It is not suggested that they are the only or the most important titles in the field. For a Marxist evaluation of the historiography of ancient Indian society, cf. R.S. Sharma in C.H. Philips, *Historians of India, Pakistan and Ceylon*.
10. This is grossly one-sided, see G.C. Pande, *Foundations of Indian Culture* (2nd ed.), vol. I, pp. 11-60; II pp. 70-81, 176-210; also S.C. Bhattacharya in the text of the volume.
11. For a critique of this view see G.C. Pande, *Studies in the Origins of Buddhism* (4th ed.), p. 602.
12. One tradition affirms 1500 years, cf. D.C. Sircar (ed.) *Bharata War and Purāṇic Genealogies* (1969), Calcutta, p. 13.
13. Its historicity is not unquestioned. Cf. Sankalia, *Rāmāyaṇa—Myth or Reality* (1973); B.B. Lal, 'Archaeology and the Indian Epics', *ABORI*, vol. IV, 1973; S.P. Gupta and K.S. Ramachandran (eds.), *Mahābhārata—Myth and Reality* (1976).
14. The identification of these names is uncertain.
15. Cf. G.C. Pande, *Studies in the Origins of Buddhism*.
16. Cf. K.S. Murty, *Vedic Hermeneutics*; G.C. Pande, *Foundations of Indian Culture*, vol. I.
17. Cf. my Presidential Address to the Indian Archaeological Society, Dharwad Session, 1978.
18. Cf. G.C. Pande, *Approach to Indian Culture and Civilization* (1985), BHU.
19. Cf. *AV*, VIII.2.21.
20. Cf. Fleet, 'The Kali Yuga Era', *JRAS*, 1911; David Frawley, *Gods, Sages and Kings*, pp. 338-40.
21. Cf. G.C. Pande, *Studies in the Origins of Buddhism* (4th ed.), pp. 603-4.
22. Cf. Tilak, *Orion* (1983); Frawley, op. cit. p. 148 ff; Kak, *Astronomical Code of the Ṛgveda*; Gorakh Prasad, *Bhāratīya Jyotiṣa*.
23. The origin of the idea has also been placed much later by some historians in the time of troubles caused by the Śaka, Hūṇa or Turkish invasion.
24. On geographical identity, cf. *Foundations*, vol. II, pp. 8-42; from an archaeological point of view cf. Subba Rao, *The Personality of India* (1958); Cunningham, *The Ancient Geography of India*.
25. Cf. G.C. Pande, *An Approach to Indian Culture and Civilization* (1985), p. 91 ff.
26. For example, *Foundations*, II, pp. 16 ff; cf. Spate, *India and Pakistan*, p. 148.
27. Spate, op. cit., l.c.
28. Cf. Lewis Mumford, *The Myth of the Machine*.
29. Cf. G.R. Sharma et al., *Beginnings of Agriculture* (1980), Allahabad; J. Hutchinson et al., *The Early History of Agriculture* (1977), London.
30. Sewell and Guha, John Marshall *Mohenjodaro and Indus Civilization* II, pp. 99-648; cf. D. Sen, *AI*, 20-21; Kennedy, *ARA*, 1980; Kenneth et al., *Purātattva*, 1984-85.
31. Cf. e.g., V.N. Mishra, *Purātattva*, 1975-76, p. 13 ff; J.H. Gordon, *Prehistoric Background of Indian Culture* (1958).
32. Cf. Frankfort, *The Birth of Civilization in the Near East*, (1951); G.C. Pande, *Meaning and Process of Culture* (1989).
33. Prof. B.B. Lal has expressed a different opinion in this volume. Cf. C.C. Lamberg-Karlovsky in *JAOS*, 1972, April-June; Dilip Chakraborty, *External Trade of the Indus Civilization* (1990).
34. The antiquity of Brahui is uncertain.
35. Cf. *AI*, 1964-65, p. 192.
36. Renfrew, *Language and Archaeology*; Ram Vilas Sharma, *Bhārata Ke Prācīna Bhāṣā Parivāra Aur Hindi* (three vols.).
37. Renfrew, op. cit.; Allchins, *Rise of Civilization*, p. 298 ff.
38. Cf. Bhagwan Singh, op. cit.
39. Cf. A.K. Sharma, *Purātattva*, 1974-75, pp. 75-76; S.P. Gupta in this volume.

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SECTION I

HISTORIOGRAPHY OF ANCIENT INDIA

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CHAPTER I

Sources of Ancient Indian History

V.C. Srivastava

It is a commonplace that sources of ancient Indian history fall into two broad categories: literature and archaeology. While the former is subdivided into sacred literature (Vedic-Epic-Purāṇic), secular literature (biographies, local chronicles, *belles-lettres* and technical) and accounts of foreign travellers, the latter is subdivided into inscriptions, coins, iconography, architecture and other material remains. Since history is being constantly rewritten and recreated with changes in emphases, perspectives and needs, as well as with the appearance of new sources and discoveries, it becomes imperative to address the old sources with new questions and re-examine the new sources and discoveries, both within the old frameworks and in the new perspectives and models. Thus a re-evaluation of sources of ancient Indian history from time to time is a most important scientific activity, rather the fundamental activity, for an objective, rational, up-to-date, meaningful reconstruction of India's past. It has become even more desirable in today's fast-changing world equipped with new techniques of retrieving the past—computers, new dating methods, multidisciplinary and interdisciplinary approaches, state-of-the-art technologies and the opening up of new fields of investigation in archaeology like marine archaeology, utilization in historical studies of new models from the social sciences, as well as the appearance of new and better editions of old texts and the discovery of new texts and new orientations. It is in this light that the sources of ancient Indian history are here being analyzed, with emphasis on the problems connected with the use of these sources.

The task is quite an onerous one, encompassing a vast area and since it is not possible to cover all the problems and new discoveries within the limits of this article, only selective information and discoveries with outstanding significance have been referred to by way of illustrating the problems and the use of new sources in their resolution.

The present essay has been divided into five sections as follows:

I. Historical Nature of Traditional Literature
II. Historicity of the Accounts of the Foreign Travellers
III. Historicity of the Non-Brāhmaṇical Literature
IV. Historicity of the Technical Literature
V. Historical Use of Archaeological Sources

I. HISTORICAL NATURE OF TRADITIONAL LITERATURE

The most important problem in relation to the sources of ancient Indian history hinges on the gulf between the vision of modern historians and that of ancient Indians towards history.

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Modern historians, educated and trained in the European concept of history, see history only as an empirical science—rational, scientific, fact-based, confined within empirical time and space. Naturally, the traditional literature of ancient India, which lacks in biographical as well as chronological elements and which is interspersed with legends, myths and superstitions, are not taken seriously by modern historians seeking empirical history. It is this vision which has led scholars to believe that ancient India lacked in historical sense, the best evidence for which has been upheld the fact that ancient India, inspite of its rich and varied Sanskrit literature, could not produce historical works like those of Greece, Rome and China. This view is buttressed by quoting Alberuni on this subject.[1] The tragedy is that these historians believe that the empirical view of history is the only correct one and none other exists. This belief emanates from the Greek-centred European ideology as well as 'Master' ideology of imperialism.

Actually, ancient India did have a sense of history of its own which was different from the empirical view of history of the West. This is related to its vision of man and time. To the modern mind, man's being is essentially and largely social and entirely historical, and wholly empirical and linear. To ancient Indians, man's being is essentially and finally spiritual and time is a cyclic or a wave-like eternity. It has been rightly pointed out that 'The two-selfed and twice-born traditional man lives in time but always acts as its victim . . . . Traditional man thus lacks the consciousness of history, that is the consciousness of unilinear time.'[2] But in ancient India man did have the consciousness of eternal time, which made him disdainful of empirical time. The ancient Indian concept of time was twofold—cosmic and spiritual, i.e. relating to *Saṁsāra* and *Mokṣa*. Man as a social being has a transitory relationship with his generations because these are simply so many steps in the march of time in which, though the past is left behind, it has a future. Man as a spiritual being takes rebirth in perennial time through *Karman* and perfects himself at a time or, rather, timelessness, which has no consciousness of the past except through indirect records. In view of this unbroken continuity of the spiritual man through *Karman*, the physical man and his generations, which are just passing moments in eternal time, have little meaning. The transcendental history of the soul is beyond empirical knowledge. Tradition is perennial although it undergoes epochal changes.[3] To quote,[4] 'History refers to these inevitable vicissitudes which may be organized into epochs but which being cyclical preserve the perennial character of time. For this reason, history tends to lose its uniqueness and tends to become illustrative.' Hence, history has been defined as 'a storehouse of wisdom, of Veda', rather than 'a collection of stock-tales'.[5] History is therefore illustrative of the moral and spiritual laws of action and change by the recollection of the past as preserved in the tradition.[6] It connects the particular empirical instances with ideal meanings and thus bridges the empirical and the transcendent. Therefore, its spiritual value is superior to that of rational philosophy as well as of mere art since it incorporates 'the supreme wisdom of the vanity of ephemeral things'.[7]

It is the traditional dimension of man as a spiritual being which forms the subject-matter of history in the eyes of the ancient Indians. Naturally, in such a highly spiritual vision of man and eternal time, history ceases to be an account of the lives of great men and the rise and fall of empires. In ancient India, history assumes the contours of a spiritual logos in which successions of ideals, beliefs, and meanings of life and culture form the theme of historical writings rather than accounts of mundane socio-political events. This difference in the vision of history is responsible for the absence of so-called historical works in ancient India rather than the external factors put forward by many in the past to account for this lacuna.[8]

Many scholars[9] have visualized and studied this *Itihāsa-Purāṇa* tradition of ancient India and have found that it was continued by the *Vaṁśas*, and *Gotra-Pravara Sūcīs*, *Gāthās* and *Nārāśaṁsīs* and *Itihāsa-Purāṇas*, *Ākhyānas* of the Vedic literature, and *Vaṁśānucarita* of the Purāṇas, and was carried forward by the regional chronicles after the sixth century AD. To start with, the Purāṇas were rejected outright as sources of history but due to the efforts of F.E.

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Pargiter, V.S. Agarwal, H.C. Hazra and many recent scholars, the relevance of the Purāṇas for the history of India after the sixth century BC has been accepted by and large, though with many reservations, corrections and modifications. There is now a general consensus that the traditions preserved in ancient Indian literature, notably in the Purāṇas, form the main source of information for the history of the earliest period and for the period before the sixth century BC, they constitute our *only* source. The Purāṇas constitute traditional history and preserve a record of those aspects of social and religious life which it thought should be preserved.

In view of the ancient Indian vision of history, the use of the Purāṇas as a source cannot be overestimated. It is generally agreed that there is a long gap between their original composition and the surviving written works (fourth century AD) and there have been many corruptions and modifications. It is quite probable that the necessity of legitimization of the non-Brāhmaṇa and foreign dynasties led to many concoctions, but it cannot be denied that the Purāṇas have preserved the social and religio-cultural history of ancient India in the manner in which our ancestors wished to preserve it. Some valuable efforts, such as those of Romila Thapar,[10] have been made to use the Purāṇas as a source of social history. Three types of information may be gleaned and used from the Purāṇas in relation to social history:

1. Geographical distribution of lineage
2. Social structure of tribes
3. Economic and political status of the agro-pastoral societies of western and central India and the more advanced agricultural societies of the middle Gaṅgā Valley.

It is to be remembered that the main concepts and ideas of historical tradition are expressed through three literary forms—genealogies, myths and historical narratives. Modern studies by social scientists have established the value of myths in historical reconstruction and it has rightly been pointed out that the myths in the Purāṇas are relevant for reconstructing the historical world-view of the authors of the text. For example, the flood legend may symbolize the beginning of history, purity of the lineage, and the division of the tribe into two, with a common ancestry.[11] The genealogical accounts in the Purāṇas may be compared with the *Vahīvaṁśas, Pothīs* and the caste Purāṇas of modern times. The Purāṇas may be used as 'historical records preserving continuity of dynasties as well as socially necessary documents establishing communities' roots in the past and more narrowly becoming the basis for the enforcement of legal claims and providing status and antiquity to social and political groups.'[12] They are also a valuable record of the socio-historical times. Historical narratives in the Purāṇas form the core of traditional historical explanations.

The historical tradition of ancient India was carried forward in Western India by the Jains in the twelfth and thirteenth centuries AD. They produced two types of literature—the *Prabandhas* and chronicles of local kings, but both must be used with the consciousness that in them moral tone overshadows historical sense. Biographies of saints, popular among Buddhists and Jains, also provide a valuable source of historical reconstruction which has not, so far, been used as it should have been. The local chronicles as of Bāṇa, Bilhaṇa, Kalhaṇa etc. have historical value but these must be used keeping in mind that they are by court chroniclers with all the negative features of the genre—like eulogy, romance, chivalry and a self-conscious striving for literary excellence.[13]

No doubt, Kalhaṇa was the first real historian of India, drawing on a variety of sources, examining them objectively, free from bias.[14] Again, the biased ideology of some historians prompts them to treat him as being outside the Indian tradition as they see Greek or Turkish impact on him but the total milieu, circumstances and the past tradition of *Itihāsa-Purāṇas* to which he draws our attention may settle him inside the Indian tradition.[15]

The Pālī chronicles of Ceylon—the *Dīpavaṁśa* and the *Mahāvaṁśa* are associated with the Indian historical tradition.[16] In view of the above synoptic review of traditional sacred

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literature, it may be said that ancient Indians did have a sense of history of their own and the historical use of these sources—Vedic-Epic-Purāṇic and *Carita* literature along with Buddhist and Jain historical traditions may be made in order to know the traditional praxis of our history which may be compared, and corroborated by other sources such as foreigner's accounts and archaeology. Without going any further into the finer points of philosophy of history in ancient India and literature of the *Itihāsa-Purāṇa* tradition, it is proposed to illustrate the use or misuse of the texts of these sources by modern historians. I would like to refer to two illustrations only—one of the Vedic and the other of the Purāṇic source. Sometimes historians ignore the references which do not conform to their thesis by discarding them as interpolations, or even completely glossing over them. The thesis that the Ṛgvedic Aryans were primarily nomadic and pastoral, as they did not have permanent settlements, did not practice agriculture etc. has been very popular for the last one decade.[17] *A Vedic Index of Names and Subjects,* by Macdonell and Keith, (1912) which is the bible for scholars on Vedic studies suffers from incompleteness. For example, there are seven references in family-books on *Vāstospati* but there is not a single reference to it in the *Index*. The *Index* has not been taken seriously in respect of references under *dama, gṛha, kṣaya, chardī* in it which go to indicate that there may have been permanent settlements among the Ṛgvedic Aryans. It is a tragedy that *Index of Names and Subjects* has been taken to be the *Index* of words by some scholars.

Let us take the case of the Ṛgvedic texts. The classification of the Ṛgvedic hymns is artificial and is not on the basis of subject-matter. Similarly, there are many variations in the two recensions of Śākala and Bāṣkala. The chronological stratification of making family-books as the earliest is also not scientific. The internal evidence of the *Ṛgveda* in its original text does testify to the fact that there are references to permanent settlements, the popularity of agriculture, agricultural labour, irrigation-management and social differentiation and stratification and cultural diversities.[18] Naturally it raises the question of reconsideration of widely popular theses like nomadic and pastoral character of the Ṛgvedic Aryans in the light of hard references from the Ṛgvedic text.

The second case is from Purāṇic studies. It has been proposed[19] on the basis of manuscripts of the *Sāmba Purāṇa* in India Office Library, London that there were two distinct groups of the Sun-priests—the Magas and the Bhojakas, because in the first group of the chapters of the *Sāmba Purāṇa,* the word '*Bhojaka*' does not occur. On this basis it was proposed that both have different origins, have different fundamentals, and varying social status. It was taken as a revolutionary discovery. After a careful perusal of the manuscripts of this *Purāṇa* in Asiatic Society, Bengal, No. 4091, 4093 it has been found[20] that the word '*Bhojaka*' does find a place in the original portion of the *Purāṇa* and this explodes the myth of two distinct groups of the Indian Sun-priests born out of the perusal of only one type of manuscripts. Naturally, the lesson that dawns on us is that theses should not be propounded without a careful perusal of many manuscripts of a Purāṇic text. Some critical editions of some Purāṇas have been published and it is better to use these editions. Some works on the basis of such critical editions in the last decade are most welcome additions to Purāṇic studies.

II. HISTORICITY OF THE ACCOUNTS OF FOREIGN TRAVELLERS

It is generally accepted that the accounts of Greek writers, the Chinese Buddhist travellers and Alberuni are valuable sources of ancient Indian history. Better editions of the Chinese accounts may provide a better understanding of the significance this source. Recently, a new critical interpretation of Hsüan Chwang's account was published in the People's Republic of China.

There is now hardly anything new to be found in Alberuni. The Greek sources suffer from many deficiencies of perspective, as well as of authenticity. They have been described

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and used by many in the past but they nevertheless still need more intensive and critical analysis at the hands of experts. In the past, historians imbued with Greek-centred bias, tended to accept these sources as containing the whole truth and utilized them for proving their Greek-oriented theories. In addition to the bias arising from the Greek orientation of Western historians, it may be noted that the Greek sources themselves see and interpret everything in a Greek light. Moreover, the tradition of early ethnographic writings has also influenced these writings. Similarly, the North-west perspective[21] of the early Greek sources is often ignored and evidence drawn from them is utilized for drawing conclusions concerning the history of India beyond the North-west, now comprising Pakistan and a part of Afghanistan. We do not have any original documents of the period from the North-west, though recently some archaeological materials from the area have become available. It has been shown that 'some of the "Indian" material in Herodotus and especially Ctesias seems to deal with Northwestern tales told about Central Asia.'[22] It should not be forgotten that the information in early Greek sources has been derived from the Achaemenian empire and it is by no means certain that the Greeks have preserved the information faithfully. To assess the authenticity of this information and to use it historically, it is absolutely essential to undertake a critical analysis of 'the actual reality of early Greek ethnography, its theory, its ideals of Greek interpretation and utopia, its attitude to primary information, native explanations and literary predecessors.'[23] A comparative study of early Greek and Indian sources with a North-western perspective has recently been done which shows the way for a better and correct utilization of early Greek sources.[24] Some other scholars[25] have also approached the subject of individual Greek authorities from this point of view. The tragedy is that very few contemporary scholars know both Greek and Sanskrit and are also familiar with the historical traditions of both the areas. The matter has been further complicated by the ethnic diversity of the North-west—the Aryans, the Iranians, the Dardic, Nuristani, the Brahuis, the Burusaski, the Tibeto-Burmans and the 'X' factors, now extinct. After a careful analysis it has been found that 'Ctesias can be used, but only when he is confirmed by some independent source.'[26] So is the case with other Greek sources.

III. HISTORICITY OF THE NON-BRĀHMANICAL LITERATURE

There are many well-known Buddhist and Jain sources. Most significant among them are: *Tripiṭakās, Lalitvistāra, Milinda Pañha,* Sinhala chronicles (already referred to above) and many later *sūtras* and philosophical texts and biographies of Buddhist saints and monks and twelve *Aṅgas, Purāṇas* and *Gāthās* of the Jains which may be found listed in any standard work of ancient Indian history. Being so numerous, it is impossible, in a short paper, even to mention all the names of these sources and as such I will only take up a few general problems in this field and reflect upon the use of these sources.

An eminent authority has expressed the view that 'a proper history of Mahāyāna still remains to be written'.[27] This is due to three factors: the major attention of scholars has been concentrated on editing and translating the Mahāyāna *sūtras* and *śāstras*; there is uncertainty concerning dates; and there is lack of communication between Hinayānic and Mahāyānic, or between traditional and modern scholars as well as lack of integration between historical and cultural, religious and philosophical approaches to the subject. The result has been a one-sided, biased and truncated picture of Mahāyāna. The sources should have been used in an integrated manner, with Hinayāna and Mahāyāna being studied not as antagonistic sects with earlier, original, and later, secondary, status respectively. Modern scholarship should have used the sources within the traditional praxis of Buddhism. It is heartening that recently such use of sources has led to a presentation of Mahāyāna in its correct perspective. It has dispelled

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the earlier prevailing theories such as the one that categorized Mahāyāna as the late form of Buddhism, or as a group of mutually inconsistent metaphysical systems, and has established that 'Mahāyāna should be understood as the Buddhist notion of universal religion' and that far from being a late distortion, it is essentially 'a continuation of some aspects of original Buddhism (not to be confused with Hinayāna)'.[28] It has further been shown in terms of traditional sources that 'a proper understanding of Mahāyānic philosophical schools requires that they should be viewed not only in the universal perspective of abstract logic but also in the concrete context of spiritual practice and experience in which their basic terms and assumptions acquire distinctive meaning.'[29]

Jainism has a vast storehouse of canonical and non-canonical sources and there are still scores of texts which remain unedited and unpublished. It would be arrogant on my part to attempt to analyse them here and it is not possible even to mention them within the limits of this paper. However, in passing, it is desirable to draw attention to a class of literature known as the *Jain Purāṇas* which are numerous and are dated from the post-Gupta period onwards. These *purāṇas* have not so far been given as much attention as is due to them. These, no doubt, are inspired by religious feeling and are born out of competition with Hinduism, but they do contain valuable socio-cultural material relevant for ancient Indian history. It would be interesting to compare their materials with the Brāhmaṇical Purāṇas against the backdrop of chronology, region and cultural context. The biographies of Buddhist and Jain monks and saints also require publication and evaluation for reconstruction of ancient Indian history.

Before I close this section, it is desirable to refer to the hypothesis of 'Shorter Buddha Chronology' currently popular in Europe. It needs a systematic evaluation in the light of many interdisciplinary approaches and traditional sources because it has thrown a challenge to the existing chronological framework of ancient India.

IV. HISTORICITY OF THE TECHNICAL LITERATURE

There are many well known technical works like those of Pāṇini, Kātyāyana, Patañjali, Kauṭilya; dramas like *Mālvikāgnimitram, Mūdrārākṣasa, Devīcandraguptam, Nāgānanda, Ratnāvalī, Priyadarśikā, Bṛhatsaṁhitā, Bṛhatjātaka, Yavana Jātaka, Viṣṇudharmottara, Mānasāra, Mānasollāsa, Nāṭya śāstra, Rūpamaṇḍaṇa, Śilparatna, Citralakṣaṇa, Abhinayadarpaṇa*; scientific works of Caraka, Suśruta, Āryabhaṭṭa, Bhāskarācārya etc., which have been used as sources for different aspect of a technical history of ancient India. We also have many valuable texts of early medieval India. Within the limited space of this paper, it is intended to refer only to some new sources or new editions of old books and their possible use for historical reconstruction. The references are arbitrarily selected and are simply illustrative of the ever-growing, ever-renewing and ever-evaluating process of historical sources and their uses.

A very rich and valuable source on ancient Indian agriculture has been produced recently in the form of a critical edition of Surapāla's *Vṛkṣāyurveda* (AD 1050-1150) by Rahul Peter Das (1988), Hamburg, on the basis of the only available manuscript in the Bodleian library, Oxford, along with variant readings, critical notes, translation into German, and botanical identifications of the terms. It has sections on *tarumahimā, nivāsāsannataru śubhāśubhalakṣaṇāni, bhūmi-nirūpaṇa, bījoptividhi, vapanavidhi, kuṇapajala, poṣaṇādhyāya, rogajñānādhyāya, cikitsā, vicitrādhyāya, Upavanaprakriyā, Kūpārtham bhūmiparīkṣā* and *annādiniṣpatti*. It has four useful appendixes. The first has additions to Sanskrit names of plants and their botanical equivalents by Maulanbeld while the remaining appendixes are associated with four texts of *Vṛkṣādohādaprakāra, Puṣpavāṭikāvidhi, Vṛkṣāropaṇa* by Sadasiva Vyasa and *Vṛkṣādināma Ropaṇaprakāra* for the first time. The value of this work cannot be

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overestimated as it could be definitive for reconstruction of different aspects of agriculture in ancient India.

Recently, an improved edition with translation and notes on *Pañcasiddhāntikā* of Varāhamihira by T.S. Kuppanna Sastri and an introduction and appendixes by K.V. Sarma (Adyar, 1993), has been published. It has the additional merit (as compared to earlier editions of Thibaut and Dwivedi, 1889, and Naugebauer and Pingree, 1970) of using all the available manuscripts, external testimony, better text, translation with explanatory notes in terms of modern mathematics with tables, diagrams and illustrative examples of computations. Naturally, such a source is of invaluable importance for historical reconstruction of five astronomical schools.

A few sources, either recently published or recently issued in editions relating to the art history of India may be mentioned here by way of examples of the growing corpus of sources. *Unknown Kāmasūtra, An Anthology of Lost Vāstuśāstra Canons* (under publication) and a new edition of *Samarāṅgaṇasūtradhara* with textual criticism, amendations and technical vocabulary and *vāstu* definitions by P.K. Agrawal, *Vāstuvidhāna Kalpa* on *maṇḍala* and *prayoga* by K.P. Sankara Somayaji and S.K. Ramachandra Rao, (eds.) (1989), Bangalore; *The Māyāmatam* (two vols.) by Bruno Lagens (1995), Delhi; *Vāstusūtra-Upaniṣad—The Essence of Form in Sacred Art,* by Boner, Sarma and Baumer; and *Ṣaḍāṅga Canons of Painting,* by P.K. Agarwal (1981), Varanasi; and many other texts along with *Encyclopaedia of Indian Temple Architecture,* by M.W. Mainster, Krishna Deva, and M.A. Dhaky and *Encyclopaedia of Indian Iconography,* (Bangalore) and *Kalātattvakośa* of the Indira Gandhi National Centre for the Arts, (New Delhi), have opened new vistas and sources concerning painting, architecture and iconography. The significance of these new or improved sources lies in the fact that all of them tend to emphasize the traditional praxis of Indian art and a careful study of these is therefore likely to lead to the emergence of a correct perspective of Indian art.

Representative of works evaluating traditional sources for the socio-cultural history of India are such efforts as those of N.N. Bhattacharya in his *Glossary of Indian Religious Terms and Concepts* (1990), New Delhi; of Anupa Pande in her *Nāṭyaśāstra Tradition and Ancient Indian Society* (1993), Jodhpur. *Śrī Rāma Viśvakośa,* edited by Singh and Verma (1992), Varanasi, must also be mentioned in this context. T.R. Trautman's work on *Kauṭilya's Arthaśāstra* with the theory of triple authorship also poses new questions.

V. HISTORICAL USE OF ARCHAEOLOGICAL SOURCES

It is true that we now have better and improved textual literary sources than were available a few decades ago and are also in a better position to use them being now conscious of and familiar with the traditional vision of history and its elements and compulsions/dimensions along with the growing orientations of modern historical writings, but it cannot be denied that literary sources for ancient Indian history, apart from their insufficiency, may at times be religiously, culturally, and regionally biased, subjective and impressionistic, even eulogistic and that the chances of discovering altogether new texts is remote. In view of this, it has rightly been pointed out that 'significant new evidence on early periods of [Indian] history is more likely to come from archaeological data than from literary sources.'[30] A meaningful collaboration between historians and archaeologists is, therefore, much to be desired. Historians must equip themselves with archaeological data and the archaeologists must be oriented towards historical questions and evidence in their field activities. Actually, archaeology has to move away from the 'pick and dig' and 'pot-tool' descriptive approach to processual and analytical archaeology. Some works have appeared in recent years which combine historical

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analysis with archaeological data and a few archaeologists have attempted processual/ analytical archaeology with interesting results.

Material remains may be very useful in new fields of study such as social and economic history, the role of technology, and evolution of cultures,[31] besides making its traditional contributions to the old fields like iconography, architecture, and epigraphy and numismatics, whose significance in new discoveries will always persist. Some models, by way of illustration, have been suggested for the collaboration of historians and archaeologists and these appear to be full of possibilities. Tracing the evolution of cultures on the basis of studies of archaeological remains may well be more profitable and revealing than seeking the identification of Aryans and Dravidians from such evidence. Models for collaboration between archaeologists and historians may usefully be adopted for studies of social evolution as evidenced by Vedic sources compared with the Painted Grey Ware archaeological cultures or by the Saṅgam literature compared with the Megalithic culture.[32]

The question of transition from tribal to agrarian and to urban (though not necessarily in a unilinear manner because sometimes there are evidences of symbiotic relationships also as in Afghanistan),[33] which is in effect a question of cultural change, may be benefited by a study of material remains, for which multidisciplinary approaches must be pressed into service, such as those of excavators, palaeobotanists, and hydrologists at the factual data level and historians, anthropologists and archaeologists at the theoretical level.[34] Frameworks like ecology, technology, human groups and socio-cultural change,[35] with a holistic approach like the systems approach may be helpful. Another example of a possible area of collaboration between historians and archaeologists could be the mapping out of the Cola villages known from written sources and to search for material remains of the same.[36] Attempts have been made to correlate Purāṇic lineages and archaeological cultures.[37] Thus there are numerous avenues for fruitful collaboration between historians and archaeologists and it is only through such combined efforts of diverse disciplines that a true image of early India can emerge.

During the last decade or so significant new discoveries have been made in different branches of archaeology. It is not possible to even name all of them here but it would be my effort to briefly focus on those discoveries which may be termed epochal or outstanding and relate them to historical problems. It is common knowledge that new chapters of the prehistory and protohistory of India, as of other regions, are solely the contributions of archaeology. Besides older discoveries such as those of Sohan, Nevasa, Bhimbetka and others, we may refer here to the discovery of Achulean habitational floors as well as a Mesolithic camp-site with a C-14 date of 7420 ± 110 BP at Paisra (Bihar),[38] which is backed by ethnographic analysis, and a complete prehistoric profile in Belan Valley, as significant additions to our sources for prehistory. Similarly, old sources of Mesolithic culture as evidenced at Laghnaj, Bagor, Bhimbetka, Morhana Pahar, Baghai Khor, Lekhaiya, Chopani Mando and other sites have been enriched by discoveries at Sarai Nahar Rai, Mahadaha and Damdama.[39] Our knowledge of the Neolithic culture of India has been enriched by discoveries at Burzahom, Gufkral, Koldihwa, Panchoh, Belan Valley, Mahagara, Chirand and north-eastern sites. These sites have filled many gaps and have a potential for contributing to the history of the transition to agrarian life.

Indus studies have gained in depth, dimension and comprehensiveness. The urban-rural dichotomy has vanished with new discoveries in Gujarat and the perspective of revolutions, uniformatarianism and monolithicism have been replaced by evolution, diversities and divergencies.[40] The continuity of the tradition has also been displayed by many new discoveries. The discovery of a Harappan trade colony at Shortughai (Afghanistan) has opened new vistas of northern contacts of the Indus culture.[41] The discovery of Indus Civilization sites in Western India such as Lothal, Rangapur, Rojdi, Prabhasa Pattan, Kuntasi, Surkotada, Dholavira, Desalpur etc., has led scholars to propose that the Harappans came to

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Gujarat to exploit the resources, process them into finished products and export them to West Asia. Initially they established fort-like settlements for needs of itinerant Harappan traders. With the flourishing of trade around 2350 BC. They established agricultural villages in the heartland of Saurashtra and raised coarser grains. 'Around 2000 BC deterioration and decline in trade sets in and deurbanization begins and they were reduced to semi-nomadic and even hunting gathering status.'[42] The theory has been propounded with great ingenuity to fulfil the demands of processual archaeology but there is much in it which seems artificial. Nevertheless, the new view point has to be given serious consideration in the light of recently discovered material sites in western India.

Dholavira (Gujarat), a Harappan city 'with enormous proportions, intricate planning delineated by an elaborate fortification, consummate architecture, fine water structures and huge accumulation of successive settlements of over a millennium has opened new horizons of the Indus civilization'[43] in the sense that there is a continued succession from pre-Harappan to post-Harappan through the Harappans at the site. Rakhigarhi and Kunal in Haryana are other recently discovered sites of Harappa culture which add to our existing knowledge of the Indus culture.

The Chalcolithic, copper-hoard, Ochre Coloured Pottery, iron age, P.G.W., Megalithic and Northern Black Polished cultures have been profusely evidenced by material remains and there is ample archaeological evidence for Indo-Roman trade also. Only some significant discoveries may briefly be mentioned. Narahan (Gorakhpur) in UP has recently revealed, 'the existence of continuous human settlement from about thirteenth century BC to the end of the Gupta Period.'[44] Of the historical sites, the remains of Harṣa-kā-ṭīlā (Thanesar) in Kurukshetra[45] have provided us with interesting information of the life-ways of the region for about 2000 years from the Kuṣāṇa (first century AD) to the Mughal period—a rare phenomenon, something comparable with Kandhara in Afghanistan. There are evidences now available for Kuṣāṇa and other periods from sites like Khairadih, Sringaverapur, Bhorgarh near Delhi, Rohtas and many others which throw interesting light on urbanization during the historical period of the country.[46] In brief, it may be said that thanks to archaeology the history of the people of India even in historic times may now be better written than was possible only a few decades earlier.

There are significant discoveries in epigraphy which throw invaluable light on different, sometimes unknown, aspects of ancient Indian history. Only very outstanding discoveries in this field[47] may be mentioned only to stress that scholars of ancient India have a fund of dynamic and ever-increasing sources which makes writing and rewriting of history an imperative exercise.

The reading of the Harappan script would really be an epoch-making achievement. The discovery of an inscribed votive jar from Bet Dwaraka from Late Harappan levels with resemblances to the Brāhmī *ma, ja* and *gha* inscriptions from Harappan Dholavira, Kunal, etc. are really significant in this connection. So is the case with the decipherment of the Kharoshti-Brāhmī and Śaṅkha scripts. Sannati (Karnataka) has recently provided us with rare Aśokan inscriptions. Vanabasi and Vasana records reveal hitherto unknown Sātavāhana rulers—Vaśiṣṭhiputra Śivaśrī Pulumāvī and Agniśarman. Records of the time of Caṣṭana from Daulatpur and Andhau (Gujarat) show that Kardamak Kṣatrapas had nothing to do with the Kuṣāṇas. The discovery of many records and coins from Andhra Pradesh reveal the existence of a hitherto unknown ruling dynasty—the Sada—before the Sātavāhanas in the region. The Miregaon seal inscription of Prabhāvatīgupta proves that Dāmodarasena and Pravarasena were brothers and not one and the same person. The question of historicity of Rāmagupta has found support from the discovery of three inscriptions from Durjanpur (Vidisa, MP). The Rāmajanmabhūmi inscription of Ayodhya has evoked much interest, publicity and notoriety also due to politics but such discoveries must be critically evaluated and utilized soberly as

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historical source-material if it is proved to be genuine. Such examples could be multiplied. These new sources, evidences can be supplemented by references to the discovery of new coins, images and temples but the limits of this paper does not permit us to go further. However, the facts cited are adequate to establish that archaeology can provide new and fresh sources of information which may enlighten many dark corners and help solve problems of ancient Indian history.

CONCLUSION

To recapitulate and conclude, it may be said that sources of ancient India are of two types, literary and archaeological. Indian literary tradition—Vedic, Purāṇic, Epic, Chronicles—did have a historical tradition which was highly spiritual, having been based on India's vision of eternal time and spiritual man with *Karman* and *Dharman* as determining factors. As such, the empiricist historians of the European tradition will be disappointed not to find historical works of the Greek or Chinese type in the literature of ancient India. Sources of ancient history have to be evaluated in the light of the tradition of the region and supplemented and corroborated by external factors. Of the foreign literary sources, the Greek writings have to be studied keeping their North-west perspective in mind and with caution since their data were rarely direct and were not free from bias of ethnographic tradition and Greek orientation.

With better, improved texts and the appearance of new sources in technical subjects, the history of science in ancient India may now be written with greater confidence than before. The Buddhist and Jain literary corpus may also be used as a corrective to the idealistic and sometimes Brāhmaṇical-oriented accounts but the religious orientations of these works should also be taken into account before we reach any sound historical conclusion.

The literary sources have to be corroborated by archaeological sources—material remains, inscriptions, coins, art and architecture etc. There is urgent need of collaboration between historians and archaeologists, working with common, agreed models and clear-cut definitions of concepts and questions. With the availability of new techniques in archaeology—computers, marine archaeology, new dating methods, archaeo-metallurgical studies, chemical analysis and other interdisciplinary approaches, the writing of ancient Indian history, with the ever-growing corpus of evidence and sources has become an interesting though onerous and complicated exercise—the production of a history which is analytical, rational, objective and meaningful, and in harmony with the aims and ideals of the Indian tradition and the dreams and aspirations of modern India. Like the Vedas the history of India is ever-growing, dynamic, and full of a life which transcends the ephemeral even as it transforms itself in time.

NOTES

1. E.C. Sachau, *Alberuni's India*, II, p. 10. He writes: 'The Hindus do not pay much attention to the historical order of things, they are very careless in relating in chronological succession of things.' Cf. Winternitz, *History of Sanskrit Literature*, vol. II, p. 208.
2. A.K. Saran, quoted by G.C. Pande, *An Approach to Indian Culture and Civilization*, Varanasi, 1985, p. 129, fn 11.
3. G.C. Pande, op. cit., 1985, pp. 127-8.
4. Ibid., p. 130.
5. Ibid., p. 131, cf. *Arthaśāstra*, 1.3.2.
6. Abhinavagupta, *Abhinavabhāratī*, vol. I, pp. 53-4; *āgamīkārthāḥ karmaphalasambandhasvabhāvāḥ*, cf. Kasika on Pāṇini, 5.4.23, *Amarakośa*, 1.6.4., 2.7.12.
7. Pañcadaśi, 7.4.2-24.

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the Stone Age in India in parts only, a holistic account of the age is not yet possible. Nevertheless it does provide a broad ecological outline of the age for several areas and at the same time provides a chronological framework. Thus in the area of the chopper/chopping complex the lower Palaeolithic goes down to two million years BP. The Acheulean hand-axe culture is also datable from 1.4 million years BP to 0.7 million years BP. The Middle Palaeolithic has given dates between 0.15 million years to 0.04 million years. The Upper Palaeolithic comes up to the beginning of the Holocene, when the Microlithic supervenes at many places, yielding in time to the Neolithic, which begins in the north-west *c.* 7000 BC, in the north *c.* 2800 BC, in the Vindhya regions *c.* 4000 BC and in the Deccan *c.* 2500 BC

Prehistoric archaeology by and large confirms the existence of the Early Stone Age man in India from at least two million years BP and has similarity to the rest of humanity with respect to the use of tools and, presumably, a simple mode of life dependent on hunting and gathering for immediate use. As the Stone Age progressed, sophistication and cultural variation also increased. When and how the domestication of animals and the cultivation of crops began in different areas in the Neolithic is still an open-ended story. That the cultivation of wheat and barley began for the first time in India in the Neolithic of the north-west appears clear but it is generally believed to owe its origin to import from West Asia, not to independent discovery. The cultivation of rice and cotton appears to have been indigenous but here too its beginning or original provenance are not wholly certain.[29] Nor is much known about the racial stock of prehistoric men in India except for some places and epochs, though the racial composition of the Indian population appears to have been more or less stable since Harappan times.[30]

Of human life in the Early Stone Age, it may be presumed that it was lived in small bands in temporary camps or shelters. Tool-making and hunting suggest the existence of social tradition and organization of which the actual forms are unknown. The Middle Palaeolithic with its more varied and sophisticated tools must have seen larger and more specialized social groups. The Upper Palaeolithic attests to the spread of rock art and burial, and presumably of many kinds of religious worship. The rock art gives us a most vivid insight into the mind and life of Late Stone Age man.[31]

With its ground and polished tools, domestication of cattle, settled habitation, surplus food production, storage and exchange, social differentiation, aesthetic creativity and religious activity, the Neolithic Age is the antechamber to the emergence of civilization. Evolutionism and diffusionism have long been debated points of view on the birth of civilization of which the latter has attracted many archaeologists in the Indian context. The discovery of the Neolithic at Meharhgarh as far back as *c.* 7000 BC and, recently, of the Chalcolithic Pre-Harappan-Early Harappan in the fourth millennium BC ought to set at rest the controversy about the origin of the Harappan civilization in India. Since the days of Marshall's monumental *Mohanjodaro and Indus Civilization* (1931) to Wheeler's *Indus Civilization* (3rd ed. 1968), the obviously Indian character of the civilization was recognized but, at the same time, its appearance of having grown up without any gradual evolution from earlier stages led to the hypothesis of the import of at least the idea of urban life and civilization from the west, just as its sudden destruction appeared to suggest that the invading Aryans of the second millennium BC ought to be held responsible for the event. Continuing research, however, has revealed wide-ranging antecedents in space and time of the Indus civilization. Thus reports of excavations from Amri (1964), Kotdiji (1965), Rahman Dheri (1982), and Tarakai Qila (1979, 1981) or from Kali Bangan (1961, 1962), Lothal (1973), Mitathala (1975), Surkotda (1971, 1972), Dvarka or Dholavira, have gradually but completely altered the perspective on the origins of the civilization. Among recent monographic discussions could be mentioned M.R. Mughal, *The Early Harappan Period in Greater Indus Valley* (1976); W.A. Fairservis, *The Roots of Ancient India* (1971); G.L. Possehl (ed.), *Harappan Civilization, A*

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Contemporary Perspective (1982); B. and R. Allchin, *The Rise of Civilization in India and Pakistan* (1984); Bhagwan Singh, *Vedic Harappans*; and the latest works of S.P. Gupta, *Sarasvatī-Indus Civilization* (1996) and B.B. Lal's, *The Earliest Civilization of South Asia* (1997).

The discussions about the emergence of the Indus civilization have been concerned with the problem of tracing the stages through which the civilization developed out of earlier Neolithic communities and the extent to which its contacts with near-eastern civilizations influenced it. Just as the development of Stone Age culture is conceived, even in the holistic approach, simply as a cumulative function or environment-cum-tool technology, i.e., as a self-sustaining process of material transformation where better tools lead to more effective and large-scale hunting, gathering and production, its surplus leading to exchange, specialization and social differentiation, similarly, the birth of a civilization is conceived as the more rapid transformation of societies through the changes in material conditions brought by a revolution in technological capability. This approach does not do justice to the nature of human civilization which is held together ultimately by moral, not material forces. Social, political and religious forms rest, not on the technology of production but on the prevailing Weltanschauung which synthesizes knowledge, values and interests into ideas which define identities, roles and goals and thus organize the norms of individual and collective behaviour. For example, the ancient Egyptian civilization arose with the idea of the Pharaoh as God on earth. In the ancient West-Asian civilization, the king was the priestly servitor of the god. All over, the Near East, the state and religion, kingship and priesthood were closely coordinated.[32] The functionaries of this sacred state administered affairs, regulated economic life, scanned the heavens, kept written records and promoted monumental arts. If the Greek civilization chose a different path, it was not on account of any discontinuity in technological capability but on account of a difference in ideas—religious and philosophical, scientific and political. Material conditions such as tools, raw materials, goods produced, means of transport, trade and settlement undoubtedly played an important role as facilitating and limiting factors in the emerging civilization but they could not be regarded as the determining or directing causes of the characteristic forms and values of the civilization.

It does not, therefore, appear convincing to seek to explain the rise and decline of the Indus civilization by the rise and decline of oceanic trade.[33] Rather, such changes in trade ought to be traced to the expansion and contraction of social vitality arising from its intellectual, moral and spiritual resources. Nor can climatic and accidental factors be anything more than challenges to be met by creative response. It is obvious, thus, that the observable rise and decline, the vicissitudes of Indus civilization would remain a mystery so long as we cannot understand its beliefs and values, the consciousness animating its material body. Even Wheeler distinguishes the material body of the Indus civilization from its spiritual legacy. The key to such an insight obviously lies in the deciphering of Indus writing.

The definitive identification of the Indus civilization itself depends on the deciphering of its script. Neither the Dravidian hypothesis adopted by the Finnish and Russian scholars and some Indian scholars, nor the much less favoured Sanskrit hypothesis adopted by some others, has met with universal acceptance. What is known of the Dravidian languages is far removed in space and time from the Indus civilization. Sanskrit, on the other hand, most likely belongs to the same or proximate space-time of the Indus civilization.[34] In either case, however, definitive decipherment must await bilingual inscriptions or much longer and more numerous inscriptions than are available upto date.

The relationship of the Harappan to the Vedic civilization has been a standing puzzle. At first it was seen as a case of obvious difference. The Aryans were supposed to have entered India in the late second millennium BC as a non-urban society with horses, speaking the Sanskrit language and worshipping iconic gods. The Harappan civilization was by then in manifest decline and had been a millennium earlier an urban civilization without horses but

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with apparently iconic worship. It knew writing while the Vedic Aryans did not for a long time. Most of these arguments have now been disputed. The very concept of race has undergone a sea-change.[35] It has been shown that the physical types in Punjab now are the same as in Harappan times. The picture of the Aryans as drawn by Schrader and Gordon Childe has been questioned. The ur-Aryan is only a construct and its vocabulary uncertain especially in its semantics.[36] This makes the task of determining the original culture and homeland of the Aryans on the basis of linguistic palaeontology an uncertain matter, in seeking to identify a pre-literate culture as Aryan, the archaeologist is left with only two diagnostic traits, viz. Chalcolithism and equine traces. On this basis some early sites in South Russia and Central Asia have been sought to be identified as early Aryan sites.[37] However, Chalcolithic features are not enough to identify the Aryans. Whether the horse can be regarded as a definitive identification or *sine qua non* of the Aryans at all places and times and whether Harappans were ignorant of the horse, are also not wholly certain.[38] Thus, in Renfrew's analysis, the Aryans seem to lose their ethnic and cultural identity and become a people who helped the spread of Chalcolithic farming culture in Europe. If we reflect over the fact that the Vedic people belong to the same or contiguous space-time of the Harappans and are also a Chalcolithic society, the similarity between them would be seen to be striking. Their spatial overlap or contiguity is most clearly seen in the role of the Sarasvatī region in both. The dating of Vedic literature in the Harappan time span is most clearly seen by astronomical evidence which has been revived since the days of Tilak and Jacobi. The presence of the horse in the Harappan space appears to have been now attested archaeologically at several places such as Surkotada.[39] Traces of a sacrificial religion are attested from several Harappan sites such as Kalibangan. That the Vedic people were illiterate or that they were ignorant of urban life have both been disputed. That Vedic interpretation is not free from ambiguity and uncertainty and is to a considerable extent dependent on the historical hypothesis assumed or regarded as credible by the interpreter, makes the task of relating Harappan and Vedic civilizations also uncertain. Nevertheless, there is no doubt that recent records tend to favour their close relationship. The distinguished contributors in this volume thus have agreed to differ on the exact nature of this relationship.

Despite the uncertainties of Vedic interpretation it has not been disputed that Vedic literature and its contents constitute the most ancient ideal foundations of Indian culture. That Indian culture has been formed by an interaction and growing synthesis of two streams, Vedic and non-Vedic, Aryan and non-Aryan, Brāhmaṇa and Śramaṇa, Brāhmaṇa and Kṣatriya, has been variably formulated by different scholars. In every case, it is Vedic literature that gives us the earliest evidence for all such formulations. That it is the Vedic vision of Truth and Right (*Satya and Ṛta*) which has been tenaciously held in Indian culture through all its vicissitudes as the essence of past tradition, is surely not a fact to be neglected by the historian. Ephemeral structures of wealth and power have not been celebrated in the Indian tradition except only as infrastructures for the establishment of a moral order (*dharma*). This continuity of ideas and emphasis on them is a characteristic feature of Indian culture so far as literary evidence goes. It is a welcome fact that interest in not only Vedic language, literature and religion, but also in Vedic philosophy and science has been revived in recent times. Indeed, the whole conception of the Vedic age has been changing as it has been placed in the perspective of a developed civilization with involvement in maritime adventure and astronomical exploration, much of which has been expressed in ritual symbolism.

NOTES

1. The views expressed by the editor do not necessarily represent the views of the contributors to the volume. On debatable issues of interpretation the different contributors have been free to express their different opinions.

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2. James Mill, *The History of British India*, 5th edn., vol. I, pp. xii-xiii. His son J.S. Mill thought that his views on liberty and representative government could not apply to India as an inferior civilization or race. Cf. Said, *Orientalism* (1955), p. 14.
3. Edward Said, *Orientalism*, p. 211.
4. Cf. Eric Stokes, *The English Utilitarians and India* (1959).
5. These titles merely illustrate some *approaches* to the *history* of philosophy. It is not suggested that they are the only or the most important titles in the field.
6. These names are also merely illustrative.
7. So Burgess (tr.), *Sūryasiddhānta* (1860), M.P. Srivastava's *Vijñāna-bhāṣya* (1940).
8. For example, N.G. Dongre, *Physics in Ancient India*, 1994, Wiley Eastern Ltd.
9. These titles merely illustrate some approaches to socio-economic history. It is not suggested that they are the only or the most important titles in the field. For a Marxist evaluation of the historiography of ancient Indian society, cf. R.S. Sharma in C.H. Philips, *Historians of India, Pakistan and Ceylon*.
10. This is grossly one-sided, see G.C. Pande, *Foundations of Indian Culture* (2nd ed.), vol. I, pp. 11-60; II pp. 70-81, 176-210; also S.C. Bhattacharya in the text of the volume.
11. For a critique of this view see G.C. Pande, *Studies in the Origins of Buddhism* (4th ed.), p. 602.
12. One tradition affirms 1500 years, cf. D.C. Sircar (ed.) *Bharata War and Purāṇic Genealogies* (1969), Calcutta, p. 13.
13. Its historicity is not unquestioned. Cf. Sankalia, *Rāmāyaṇa—Myth or Reality* (1973); B.B. Lal, 'Archaeology and the Indian Epics', *ABORI*, vol. IV, 1973; S.P. Gupta and K.S. Ramachandran (eds.), *Mahābhārata—Myth and Reality* (1976).
14. The identification of these names is uncertain.
15. Cf. G.C. Pande, *Studies in the Origins of Buddhism*.
16. Cf. K.S. Murty, *Vedic Hermeneutics*; G.C. Pande, *Foundations of Indian Culture*, vol. I.
17. Cf. my Presidential Address to the Indian Archaeological Society, Dharwad Session, 1978.
18. Cf. G.C. Pande, *Approach to Indian Culture and Civilization* (1985), BHU.
19. Cf. *AV*, VIII.2.21.
20. Cf. Fleet, 'The Kali Yuga Era', *JRAS*, 1911; David Frawley, *Gods, Sages and Kings*, pp. 338-40.
21. Cf. G.C. Pande, *Studies in the Origins of Buddhism* (4th ed.), pp. 603-4.
22. Cf. Tilak, *Orion* (1983); Frawley, op. cit. p. 148 ff; Kak, *Astronomical Code of the Ṛgveda*; Gorakh Prasad, *Bhāratīya Jyotiṣa*.
23. The origin of the idea has also been placed much later by some historians in the time of troubles caused by the Śaka, Hūṇa or Turkish invasion.
24. On geographical identity, cf. *Foundations*, vol. II, pp. 8-42; from an archaeological point of view cf. Subba Rao, *The Personality of India* (1958); Cunningham, *The Ancient Geography of India*.
25. Cf. G.C. Pande, *An Approach to Indian Culture and Civilization* (1985), p. 91 ff.
26. For example, *Foundations*, II, pp. 16 ff; cf. Spate, *India and Pakistan*, p. 148.
27. Spate, op. cit., l.c.
28. Cf. Lewis Mumford, *The Myth of the Machine*.
29. Cf. G.R. Sharma et al., *Beginnings of Agriculture* (1980), Allahabad; J. Hutchinson et al., *The Early History of Agriculture* (1977), London.
30. Sewell and Guha, John Marshall *Mohenjodaro and Indus Civilization* II, pp. 99-648; cf. D. Sen, *AI*, 20-21; Kennedy, *ARA*, 1980; Kenneth et al., *Purātattva*, 1984-85.
31. Cf. e.g., V.N. Mishra, *Purātattva*, 1975-76, p. 13 ff; J.H. Gordon, *Prehistoric Background of Indian Culture* (1958).
32. Cf. Frankfort, *The Birth of Civilization in the Near East*, (1951); G.C. Pande, *Meaning and Process of Culture* (1989).
33. Prof. B.B. Lal has expressed a different opinion in this volume. Cf. C.C. Lamberg-Karlovsky in *JAOS*, 1972, April-June; Dilip Chakraborty, *External Trade of the Indus Civilization* (1990).
34. The antiquity of Brahui is uncertain.
35. Cf. *AI*, 1964-65, p. 192.
36. Renfrew, *Language and Archaeology*; Ram Vilas Sharma, *Bhārata Ke Prācīna Bhāṣā Parivāra Aur Hindi* (three vols.).
37. Renfrew, op. cit.; Allchins, *Rise of Civilization*, p. 298 ff.
38. Cf. Bhagwan Singh, op. cit.
39. Cf. A.K. Sharma, *Purātattva*, 1974-75, pp. 75-76; S.P. Gupta in this volume.

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SECTION I

HISTORIOGRAPHY OF ANCIENT INDIA

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CHAPTER I

Sources of Ancient Indian History

V.C. Srivastava

It is a commonplace that sources of ancient Indian history fall into two broad categories: literature and archaeology. While the former is subdivided into sacred literature (Vedic-Epic-Purāṇic), secular literature (biographies, local chronicles, *belles-lettres* and technical) and accounts of foreign travellers, the latter is subdivided into inscriptions, coins, iconography, architecture and other material remains. Since history is being constantly rewritten and recreated with changes in emphases, perspectives and needs, as well as with the appearance of new sources and discoveries, it becomes imperative to address the old sources with new questions and re-examine the new sources and discoveries, both within the old frameworks and in the new perspectives and models. Thus a re-evaluation of sources of ancient Indian history from time to time is a most important scientific activity, rather the fundamental activity, for an objective, rational, up-to-date, meaningful reconstruction of India's past. It has become even more desirable in today's fast-changing world equipped with new techniques of retrieving the past—computers, new dating methods, multidisciplinary and interdisciplinary approaches, state-of-the-art technologies and the opening up of new fields of investigation in archaeology like marine archaeology, utilization in historical studies of new models from the social sciences, as well as the appearance of new and better editions of old texts and the discovery of new texts and new orientations. It is in this light that the sources of ancient Indian history are here being analyzed, with emphasis on the problems connected with the use of these sources.

The task is quite an onerous one, encompassing a vast area and since it is not possible to cover all the problems and new discoveries within the limits of this article, only selective information and discoveries with outstanding significance have been referred to by way of illustrating the problems and the use of new sources in their resolution.

The present essay has been divided into five sections as follows:

I. Historical Nature of Traditional Literature
II. Historicity of the Accounts of the Foreign Travellers
III. Historicity of the Non-Brāhmaṇical Literature
IV. Historicity of the Technical Literature
V. Historical Use of Archaeological Sources

I. HISTORICAL NATURE OF TRADITIONAL LITERATURE

The most important problem in relation to the sources of ancient Indian history hinges on the gulf between the vision of modern historians and that of ancient Indians towards history.

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Modern historians, educated and trained in the European concept of history, see history only as an empirical science—rational, scientific, fact-based, confined within empirical time and space. Naturally, the traditional literature of ancient India, which lacks in biographical as well as chronological elements and which is interspersed with legends, myths and superstitions, are not taken seriously by modern historians seeking empirical history. It is this vision which has led scholars to believe that ancient India lacked in historical sense, the best evidence for which has been upheld the fact that ancient India, inspite of its rich and varied Sanskrit literature, could not produce historical works like those of Greece, Rome and China. This view is buttressed by quoting Alberuni on this subject.[1] The tragedy is that these historians believe that the empirical view of history is the only correct one and none other exists. This belief emanates from the Greek-centred European ideology as well as 'Master' ideology of imperialism.

Actually, ancient India did have a sense of history of its own which was different from the empirical view of history of the West. This is related to its vision of man and time. To the modern mind, man's being is essentially and largely social and entirely historical, and wholly empirical and linear. To ancient Indians, man's being is essentially and finally spiritual and time is a cyclic or a wave-like eternity. It has been rightly pointed out that 'The two-selfed and twice-born traditional man lives in time but always acts as its victim .... Traditional man thus lacks the consciousness of history, that is the consciousness of unilinear time.'[2] But in ancient India man did have the consciousness of eternal time, which made him disdainful of empirical time. The ancient Indian concept of time was twofold—cosmic and spiritual, i.e. relating to *Saṁsāra* and *Mokṣa*. Man as a social being has a transitory relationship with his generations because these are simply so many steps in the march of time in which, though the past is left behind, it has a future. Man as a spiritual being takes rebirth in perennial time through *Karman* and perfects himself at a time or, rather, timelessness, which has no consciousness of the past except through indirect records. In view of this unbroken continuity of the spiritual man through *Karman*, the physical man and his generations, which are just passing moments in eternal time, have little meaning. The transcendental history of the soul is beyond empirical knowledge. Tradition is perennial although it undergoes epochal changes.[3] To quote,[4] 'History refers to these inevitable vicissitudes which may be organized into epochs but which being cyclical preserve the perennial character of time. For this reason, history tends to lose its uniqueness and tends to become illustrative.' Hence, history has been defined as 'a storehouse of wisdom, of Veda', rather than 'a collection of stock-tales'.[5] History is therefore illustrative of the moral and spiritual laws of action and change by the recollection of the past as preserved in the tradition.[6] It connects the particular empirical instances with ideal meanings and thus bridges the empirical and the transcendent. Therefore, its spiritual value is superior to that of rational philosophy as well as of mere art since it incorporates 'the supreme wisdom of the vanity of ephemeral things'.[7]

It is the traditional dimension of man as a spiritual being which forms the subject-matter of history in the eyes of the ancient Indians. Naturally, in such a highly spiritual vision of man and eternal time, history ceases to be an account of the lives of great men and the rise and fall of empires. In ancient India, history assumes the contours of a spiritual logos in which successions of ideals, beliefs, and meanings of life and culture form the theme of historical writings rather than accounts of mundane socio-political events. This difference in the vision of history is responsible for the absence of so-called historical works in ancient India rather than the external factors put forward by many in the past to account for this lacuna.[8]

Many scholars[9] have visualized and studied this *Itihāsa-Purāṇa* tradition of ancient India and have found that it was continued by the *Vaṁśas*, and *Gotra-Pravara Sūcīs*, *Gāthās* and *Nārāśaṁsīs* and *Itihāsa-Purāṇas*, *Ākhyānas* of the Vedic literature, and *Yaṁśānucarita* of the Purāṇas, and was carried forward by the regional chronicles after the sixth century AD. To start with, the Purāṇas were rejected outright as sources of history but due to the efforts of F.E.

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Pargiter, V.S. Agarwal, H.C. Hazra and many recent scholars, the relevance of the Purāṇas for the history of India after the sixth century BC has been accepted by and large, though with many reservations, corrections and modifications. There is now a general consensus that the traditions preserved in ancient Indian literature, notably in the Purāṇas, form the main source of information for the history of the earliest period and for the period before the sixth century BC, they constitute our *only* source. The Purāṇas constitute traditional history and preserve a record of those aspects of social and religious life which it thought should be preserved.

In view of the ancient Indian vision of history, the use of the Purāṇas as a source cannot be overestimated. It is generally agreed that there is a long gap between their original composition and the surviving written works (fourth century AD) and there have been many corruptions and modifications. It is quite probable that the necessity of legitimization of the non-Brāhmaṇa and foreign dynasties led to many concoctions, but it cannot be denied that the Purāṇas have preserved the social and religio-cultural history of ancient India in the manner in which our ancestors wished to preserve it. Some valuable efforts, such as those of Romila Thapar,[10] have been made to use the Purāṇas as a source of social history. Three types of information may be gleaned and used from the Purāṇas in relation to social history:

1. Geographical distribution of lineage
2. Social structure of tribes
3. Economic and political status of the agro-pastoral societies of western and central India and the more advanced agricultural societies of the middle Gaṅgā Valley.

It is to be remembered that the main concepts and ideas of historical tradition are expressed through three literary forms—genealogies, myths and historical narratives. Modern studies by social scientists have established the value of myths in historical reconstruction and it has rightly been pointed out that the myths in the Purāṇas are relevant for reconstructing the historical world-view of the authors of the text. For example, the flood legend may symbolize the beginning of history, purity of the lineage, and the division of the tribe into two, with a common ancestry.[11] The genealogical accounts in the Purāṇas may be compared with the *Vahīvaṁśas*, *Pothīs* and the caste Purāṇas of modern times. The Purāṇas may be used as 'historical records preserving continuity of dynasties as well as socially necessary documents establishing communities' roots in the past and more narrowly becoming the basis for the enforcement of legal claims and providing status and antiquity to social and political groups.'[12] They are also a valuable record of the socio-historical times. Historical narratives in the Purāṇas form the core of traditional historical explanations.

The historical tradition of ancient India was carried forward in Western India by the Jains in the twelfth and thirteenth centuries AD. They produced two types of literature—the *Prabandhas* and chronicles of local kings, but both must be used with the consciousness that in them moral tone overshadows historical sense. Biographies of saints, popular among Buddhists and Jains, also provide a valuable source of historical reconstruction which has not, so far, been used as it should have been. The local chronicles as of Bāṇa, Bilhaṇa, Kalhaṇa etc. have historical value but these must be used keeping in mind that they are by court chroniclers with all the negative features of the genre—like eulogy, romance, chivalry and a self-conscious striving for literary excellence.[13]

No doubt, Kalhaṇa was the first real historian of India, drawing on a variety of sources, examining them objectively, free from bias.[14] Again, the biased ideology of some historians prompts them to treat him as being outside the Indian tradition as they see Greek or Turkish impact on him but the total milieu, circumstances and the past tradition of *Itihāsa-Purāṇas* to which he draws our attention may settle him inside the Indian tradition.[15]

The Pālī chronicles of Ceylon—the *Dīpavaṁśa* and the *Mahāvaṁśa* are associated with the Indian historical tradition.[16] In view of the above synoptic review of traditional sacred

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literature, it may be said that ancient Indians did have a sense of history of their own and the historical use of these sources—Vedic-Epic-Purāṇic and *Carita* literature along with Buddhist and Jain historical traditions may be made in order to know the traditional praxis of our history which may be compared, and corroborated by other sources such as foreigner's accounts and archaeology. Without going any further into the finer points of philosophy of history in ancient India and literature of the *Itihāsa-Purāṇa* tradition, it is proposed to illustrate the use or misuse of the texts of these sources by modern historians. I would like to refer to two illustrations only—one of the Vedic and the other of the Purāṇic source. Sometimes historians ignore the references which do not conform to their thesis by discarding them as interpolations, or even completely glossing over them. The thesis that the Ṛgvedic Aryans were primarily nomadic and pastoral, as they did not have permanent settlements, did not practice agriculture etc. has been very popular for the last one decade.[17] *A Vedic Index of Names and Subjects,* by Macdonell and Keith, (1912) which is the bible for scholars on Vedic studies suffers from incompleteness. For example, there are seven references in family-books on *Vāstospati* but there is not a single reference to it in the *Index*. The *Index* has not been taken seriously in respect of references under *dama, gṛha, kṣaya, chardī* in it which go to indicate that there may have been permanent settlements among the Ṛgvedic Aryans. It is a tragedy that *Index of Names and Subjects* has been taken to be the *Index* of words by some scholars.

Let us take the case of the Ṛgvedic texts. The classification of the Ṛgvedic hymns is artificial and is not on the basis of subject-matter. Similarly, there are many variations in the two recensions of Śākala and Bāṣkala. The chronological stratification of making family-books as the earliest is also not scientific. The internal evidence of the *Ṛgveda* in its original text does testify to the fact that there are references to permanent settlements, the popularity of agriculture, agricultural labour, irrigation-management and social differentiation and stratification and cultural diversities.[18] Naturally it raises the question of reconsideration of widely popular theses like nomadic and pastoral character of the Ṛgvedic Aryans in the light of hard references from the Ṛgvedic text.

The second case is from Purāṇic studies. It has been proposed[19] on the basis of manuscripts of the *Sāmba Purāṇa* in India Office Library, London that there were two distinct groups of the Sun-priests—the Magas and the Bhojakas, because in the first group of the chapters of the *Sāmba Purāṇa,* the word '*Bhojaka*' does not occur. On this basis it was proposed that both have different origins, have different fundamentals, and varying social status. It was taken as a revolutionary discovery. After a careful perusal of the manuscripts of this *Purāṇa* in Asiatic Society, Bengal, No. 4091, 4093 it has been found[20] that the word '*Bhojaka*' does find a place in the original portion of the *Purāṇa* and this explodes the myth of two distinct groups of the Indian Sun-priests born out of the perusal of only one type of manuscripts. Naturally, the lesson that dawns on us is that theses should not be propounded without a careful perusal of many manuscripts of a Purāṇic text. Some critical editions of some Purāṇas have been published and it is better to use these editions. Some works on the basis of such critical editions in the last decade are most welcome additions to Purāṇic studies.

II. HISTORICITY OF THE ACCOUNTS OF FOREIGN TRAVELLERS

It is generally accepted that the accounts of Greek writers, the Chinese Buddhist travellers and Alberuni are valuable sources of ancient Indian history. Better editions of the Chinese accounts may provide a better understanding of the significance this source. Recently, a new critical interpretation of Hsūan Chwang's account was published in the People's Republic of China.

There is now hardly anything new to be found in Alberuni. The Greek sources suffer from many deficiencies of perspective, as well as of authenticity. They have been described

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and used by many in the past but they nevertheless still need more intensive and critical analysis at the hands of experts. In the past, historians imbued with Greek-centred bias, tended to accept these sources as containing the whole truth and utilized them for proving their Greek-oriented theories. In addition to the bias arising from the Greek orientation of Western historians, it may be noted that the Greek sources themselves see and interpret everything in a Greek light. Moreover, the tradition of early ethnographic writings has also influenced these writings. Similarly, the North-west perspective[21] of the early Greek sources is often ignored and evidence drawn from them is utilized for drawing conclusions concerning the history of India beyond the North-west, now comprising Pakistan and a part of Afghanistan. We do not have any original documents of the period from the North-west, though recently some archaeological materials from the area have become available. It has been shown that 'some of the "Indian" material in Herodotus and especially Ctesias seems to deal with Northwestern tales told about Central Asia.'[22] It should not be forgotten that the information in early Greek sources has been derived from the Achaemenian empire and it is by no means certain that the Greeks have preserved the information faithfully. To assess the authenticity of this information and to use it historically, it is absolutely essential to undertake a critical analysis of 'the actual reality of early Greek ethnography, its theory, its ideals of Greek interpretation and utopia, its attitude to primary information, native explanations and literary predecessors.'[23] A comparative study of early Greek and Indian sources with a North-western perspective has recently been done which shows the way for a better and correct utilization of early Greek sources.[24] Some other scholars[25] have also approached the subject of individual Greek authorities from this point of view. The tragedy is that very few contemporary scholars know both Greek and Sanskrit and are also familiar with the historical traditions of both the areas. The matter has been further complicated by the ethnic diversity of the North-west—the Aryans, the Iranians, the Dardic, Nuristani, the Brahuis, the Burusaski, the Tibeto-Burmans and the 'X' factors, now extinct. After a careful analysis it has been found that 'Ctesias can be used, but only when he is confirmed by some independent source.'[26] So is the case with other Greek sources.

III. HISTORICITY OF THE NON-BRĀHMANICAL LITERATURE

There are many well-known Buddhist and Jain sources. Most significant among them are: *Tripiṭakās, Lalitvistāra, Milinda Pañha,* Sinhala chronicles (already referred to above) and many later *sūtras* and philosophical texts and biographies of Buddhist saints and monks and twelve *Aṅgas, Purāṇas* and *Gāthās* of the Jains which may be found listed in any standard work of ancient Indian history. Being so numerous, it is impossible, in a short paper, even to mention all the names of these sources and as such I will only take up a few general problems in this field and reflect upon the use of these sources.

An eminent authority has expressed the view that 'a proper history of Mahāyāna still remains to be written'.[27] This is due to three factors: the major attention of scholars has been concentrated on editing and translating the Mahāyāna *sūtras* and *śāstras*; there is uncertainty concerning dates; and there is lack of communication between Hinayānic and Mahāyānic, or between traditional and modern scholars as well as lack of integration between historical and cultural, religious and philosophical approaches to the subject. The result has been a one-sided, biased and truncated picture of Mahāyāna. The sources should have been used in an integrated manner, with Hinayāna and Mahāyāna being studied not as antagonistic sects with earlier, original, and later, secondary, status respectively. Modern scholarship should have used the sources within the traditional praxis of Buddhism. It is heartening that recently such use of sources has led to a presentation of Mahāyāna in its correct perspective. It has dispelled

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the earlier prevailing theories such as the one that categorized Mahāyāna as the late form of Buddhism, or as a group of mutually inconsistent metaphysical systems, and has established that 'Mahāyāna should be understood as the Buddhist notion of universal religion' and that far from being a late distortion, it is essentially 'a continuation of some aspects of original Buddhism (not to be confused with Hinayāna)'.[28] It has further been shown in terms of traditional sources that 'a proper understanding of Mahāyānic philosophical schools requires that they should be viewed not only in the universal perspective of abstract logic but also in the concrete context of spiritual practice and experience in which their basic terms and assumptions acquire distinctive meaning.'[29]

Jainism has a vast storehouse of canonical and non-canonical sources and there are still scores of texts which remain unedited and unpublished. It would be arrogant on my part to attempt to analyse them here and it is not possible even to mention them within the limits of this paper. However, in passing, it is desirable to draw attention to a class of literature known as the *Jain Purāṇas* which are numerous and are dated from the post-Gupta period onwards. These *purāṇas* have not so far been given as much attention as is due to them. These, no doubt, are inspired by religious feeling and are born out of competition with Hinduism, but they do contain valuable socio-cultural material relevant for ancient Indian history. It would be interesting to compare their materials with the Brāhmaṇical Purāṇas against the backdrop of chronology, region and cultural context. The biographies of Buddhist and Jain monks and saints also require publication and evaluation for reconstruction of ancient Indian history.

Before I close this section, it is desirable to refer to the hypothesis of 'Shorter Buddha Chronology' currently popular in Europe. It needs a systematic evaluation in the light of many interdisciplinary approaches and traditional sources because it has thrown a challenge to the existing chronological framework of ancient India.

IV. HISTORICITY OF THE TECHNICAL LITERATURE

There are many well known technical works like those of Pāṇini, Kātyāyana, Patañjali, Kauṭilya; dramas like *Mālvikāgnimitram, Mūdrārākṣasa, Devīcandraguptam, Nāgānanda, Ratnāvalī, Priyadarśikā, Bṛhatsaṁhitā, Bṛhatjātaka, Yavana Jātaka, Viṣṇudharmottara, Mānasāra, Mānasollāsa, Nāṭya śāstra, Rūpamanḍaṇa, Śilparatna, Citralakṣaṇa, Abhinayadarpaṇa*; scientific works of Caraka, Suśruta, Āryabhaṭṭa, Bhāskarācārya etc., which have been used as sources for different aspect of a technical history of ancient India. We also have many valuable texts of early medieval India. Within the limited space of this paper, it is intended to refer only to some new sources or new editions of old books and their possible use for historical reconstruction. The references are arbitrarily selected and are simply illustrative of the ever-growing, ever-renewing and ever-evaluating process of historical sources and their uses.

A very rich and valuable source on ancient Indian agriculture has been produced recently in the form of a critical edition of Surapāla's *Vṛkṣāyurveda* (AD 1050-1150) by Rahul Peter Das (1988), Hamburg, on the basis of the only available manuscript in the Bodleian library, Oxford, along with variant readings, critical notes, translation into German, and botanical identifications of the terms. It has sections on *tarumahimā, nivāsāsannataru śubhāśubhalakṣaṇāni, bhūmi-nirūpaṇa, bījoptividhi, vapanavidhi, kuṇapajala, poṣaṇādhyāya, rogajñānādhyāya, cikitsā, vicitrādhyāya, Upavanaprakriyā, Kūpārtham bhūmiparīkṣā* and *annādiniṣpatti*. It has four useful appendixes. The first has additions to Sanskrit names of plants and their botanical equivalents by Maulanbeld while the remaining appendixes are associated with four texts of *Vṛkṣādohādaprakāra, Puṣpavāṭikāvidhi, Vṛkṣāropaṇa* by Sadasiva Vyasa and *Vṛkṣādināma Ropaṇaprakāra* for the first time. The value of this work cannot be

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overestimated as it could be definitive for reconstruction of different aspects of agriculture in ancient India.

Recently, an improved edition with translation and notes on *Pañcasiddhāntikā* of Varāhamihira by T.S. Kuppanna Sastri and an introduction and appendixes by K.V. Sarma (Adyar, 1993), has been published. It has the additional merit (as compared to earlier editions of Thibaut and Dwivedi, 1889, and Naugebauer and Pingree, 1970) of using all the available manuscripts, external testimony, better text, translation with explanatory notes in terms of modern mathematics with tables, diagrams and illustrative examples of computations. Naturally, such a source is of invaluable importance for historical reconstruction of five astronomical schools.

A few sources, either recently published or recently issued in editions relating to the art history of India may be mentioned here by way of examples of the growing corpus of sources. *Unknown Kāmasūtra, An Anthology of Lost Vāstuśāstra Canons* (under publication) and a new edition of *Samarāṅgaṇasūtradhara* with textual criticism, amendations and technical vocabulary and *vāstu* definitions by P.K. Agrawal, *Vāstuvidhāna Kalpa* on *maṇḍala* and *prayoga* by K.P. Sankara Somayaji and S.K. Ramachandra Rao, (eds.) (1989), Bangalore; *The Māyāmatam* (two vols.) by Bruno Lagens (1995), Delhi; *Vāstusūtra-Upaniṣad—The Essence of Form in Sacred Art,* by Boner, Sarma and Baumer; and *Ṣaḍāṅga Canons of Painting,* by P.K. Agarwal (1981), Varanasi; and many other texts along with *Encyclopaedia of Indian Temple Architecture,* by M.W. Mainster, Krishna Deva, and M.A. Dhaky and *Encyclopaedia of Indian Iconography,* (Bangalore) and *Kalātattvakośa* of the Indira Gandhi National Centre for the Arts, (New Delhi), have opened new vistas and sources concerning painting, architecture and iconography. The significance of these new or improved sources lies in the fact that all of them tend to emphasize the traditional praxis of Indian art and a careful study of these is therefore likely to lead to the emergence of a correct perspective of Indian art.

Representative of works evaluating traditional sources for the socio-cultural history of India are such efforts as those of N.N. Bhattacharya in his *Glossary of Indian Religious Terms and Concepts* (1990), New Delhi; of Anupa Pande in her *Nāṭyaśāstra Tradition and Ancient Indian Society* (1993), Jodhpur. *Śrī Rāma Viśvakośa,* edited by Singh and Verma (1992), Varanasi, must also be mentioned in this context. T.R. Trautman's work on *Kauṭilya's Arthaśāstra* with the theory of triple authorship also poses new questions.

V. HISTORICAL USE OF ARCHAEOLOGICAL SOURCES

It is true that we now have better and improved textual literary sources than were available a few decades ago and are also in a better position to use them being now conscious of and familiar with the traditional vision of history and its elements and compulsions/dimensions along with the growing orientations of modern historical writings, but it cannot be denied that literary sources for ancient Indian history, apart from their insufficiency, may at times be religiously, culturally, and regionally biased, subjective and impressionistic, even eulogistic and that the chances of discovering altogether new texts is remote. In view of this, it has rightly been pointed out that 'significant new evidence on early periods of [Indian] history is more likely to come from archaeological data than from literary sources.'[30] A meaningful collaboration between historians and archaeologists is, therefore, much to be desired. Historians must equip themselves with archaeological data and the archaeologists must be oriented towards historical questions and evidence in their field activities. Actually, archaeology has to move away from the 'pick and dig' and 'pot-tool' descriptive approach to processual and analytical archaeology. Some works have appeared in recent years which combine historical

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analysis with archaeological data and a few archaeologists have attempted processual/ analytical archaeology with interesting results.

Material remains may be very useful in new fields of study such as social and economic history, the role of technology, and evolution of cultures,[31] besides making its traditional contributions to the old fields like iconography, architecture, and epigraphy and numismatics, whose significance in new discoveries will always persist. Some models, by way of illustration, have been suggested for the collaboration of historians and archaeologists and these appear to be full of possibilities. Tracing the evolution of cultures on the basis of studies of archaeological remains may well be more profitable and revealing than seeking the identification of Aryans and Dravidians from such evidence. Models for collaboration between archaeologists and historians may usefully be adopted for studies of social evolution as evidenced by Vedic sources compared with the Painted Grey Ware archaeological cultures or by the Saṅgam literature compared with the Megalithic culture.[32]

The question of transition from tribal to agrarian and to urban (though not necessarily in a unilinear manner because sometimes there are evidences of symbiotic relationships also as in Afghanistan),[33] which is in effect a question of cultural change, may be benefited by a study of material remains, for which multidisciplinary approaches must be pressed into service, such as those of excavators, palaeobotanists, and hydrologists at the factual data level and historians, anthropologists and archaeologists at the theoretical level.[34] Frameworks like ecology, technology, human groups and socio-cultural change,[35] with a holistic approach like the systems approach may be helpful. Another example of a possible area of collaboration between historians and archaeologists could be the mapping out of the Cola villages known from written sources and to search for material remains of the same.[36] Attempts have been made to correlate Purāṇic lineages and archaeological cultures.[37] Thus there are numerous avenues for fruitful collaboration between historians and archaeologists and it is only through such combined efforts of diverse disciplines that a true image of early India can emerge.

During the last decade or so significant new discoveries have been made in different branches of archaeology. It is not possible to even name all of them here but it would be my effort to briefly focus on those discoveries which may be termed epochal or outstanding and relate them to historical problems. It is common knowledge that new chapters of the prehistory and protohistory of India, as of other regions, are solely the contributions of archaeology. Besides older discoveries such as those of Sohan, Nevasa, Bhimbetka and others, we may refer here to the discovery of Achulean habitational floors as well as a Mesolithic camp-site with a C-14 date of 7420 ± 110 BP at Paisra (Bihar),[38] which is backed by ethnographic analysis, and a complete prehistoric profile in Belan Valley, as significant additions to our sources for prehistory. Similarly, old sources of Mesolithic culture as evidenced at Laghnaj, Bagor, Bhimbetka, Morhana Pahar, Baghai Khor, Lekhaiya, Chopani Mando and other sites have been enriched by discoveries at Sarai Nahar Rai, Mahadaha and Damdama.[39] Our knowledge of the Neolithic culture of India has been enriched by discoveries at Burzahom, Gufkral, Koldihwa, Panchoh, Belan Valley, Mahagara, Chirand and north-eastern sites. These sites have filled many gaps and have a potential for contributing to the history of the transition to agrarian life.

Indus studies have gained in depth, dimension and comprehensiveness. The urban-rural dichotomy has vanished with new discoveries in Gujarat and the perspective of revolutions, uniformatarianism and monolithicism have been replaced by evolution, diversities and divergencies.[40] The continuity of the tradition has also been displayed by many new discoveries. The discovery of a Harappan trade colony at Shortughai (Afghanistan) has opened new vistas of northern contacts of the Indus culture.[41] The discovery of Indus Civilization sites in Western India such as Lothal, Rangapur, Rojdi, Prabhasa Pattan, Kuntasi, Surkotada, Dholavira, Desalpur etc., has led scholars to propose that the Harappans came to

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Gujarat to exploit the resources, process them into finished products and export them to West Asia. Initially they established fort-like settlements for needs of itinerant Harappan traders. With the flourishing of trade around 2350 BC. They established agricultural villages in the heartland of Saurashtra and raised coarser grains. 'Around 2000 BC deterioration and decline in trade sets in and deurbanization begins and they were reduced to semi-nomadic and even hunting gathering status.'[42] The theory has been propounded with great ingenuity to fulfil the demands of processual archaeology but there is much in it which seems artificial. Nevertheless, the new view point has to be given serious consideration in the light of recently discovered material sites in western India.

Dholavira (Gujarat), a Harappan city 'with enormous proportions, intricate planning delineated by an elaborate fortification, consummate architecture, fine water structures and huge accumulation of successive settlements of over a millennium has opened new horizons of the Indus civilization'[43] in the sense that there is a continued succession from pre-Harappan to post-Harappan through the Harappans at the site. Rakhigarhi and Kunal in Haryana are other recently discovered sites of Harappa culture which add to our existing knowledge of the Indus culture.

The Chalcolithic, copper-hoard, Ochre Coloured Pottery, iron age, P.G.W., Megalithic and Northern Black Polished cultures have been profusely evidenced by material remains and there is ample archaeological evidence for Indo-Roman trade also. Only some significant discoveries may briefly be mentioned. Narahan (Gorakhpur) in UP has recently revealed, 'the existence of continuous human settlement from about thirteenth century BC to the end of the Gupta Period.'[44] Of the historical sites, the remains of Harṣa-kā-ṭīlā (Thanesar) in Kurukshetra[45] have provided us with interesting information of the life-ways of the region for about 2000 years from the Kuṣāṇa (first century AD) to the Mughal period—a rare phenomenon, something comparable with Kandhara in Afghanistan. There are evidences now available for Kuṣāṇa and other periods from sites like Khairadih, Sringaverapur, Bhorgarh near Delhi, Rohtas and many others which throw interesting light on urbanization during the historical period of the country.[46] In brief, it may be said that thanks to archaeology the history of the people of India even in historic times may now be better written than was possible only a few decades earlier.

There are significant discoveries in epigraphy which throw invaluable light on different, sometimes unknown, aspects of ancient Indian history. Only very outstanding discoveries in this field[47] may be mentioned only to stress that scholars of ancient India have a fund of dynamic and ever-increasing sources which makes writing and rewriting of history an imperative exercise.

The reading of the Harappan script would really be an epoch-making achievement. The discovery of an inscribed votive jar from Bet Dwaraka from Late Harappan levels with resemblances to the Brāhmī *ma, ja* and *gha* inscriptions from Harappan Dholavira, Kunal, etc. are really significant in this connection. So is the case with the decipherment of the Kharoshti-Brāhmī and Śaṅkha scripts. Sannati (Karnataka) has recently provided us with rare Aśokan inscriptions. Vanabasi and Vasana records reveal hitherto unknown Sātavāhana rulers—Vaśiṣṭhiputra Śivaśrī Pulumāvī and Agniśarman. Records of the time of Caṣṭana from Daulatpur and Andhau (Gujarat) show that Kardamak Kṣatrapas had nothing to do with the Kuṣāṇas. The discovery of many records and coins from Andhra Pradesh reveal the existence of a hitherto unknown ruling dynasty—the Sada—before the Sātavāhanas in the region. The Miregaon seal inscription of Prabhāvatīgupta proves that Dāmodarasena and Pravarasena were brothers and not one and the same person. The question of historicity of Rāmagupta has found support from the discovery of three inscriptions from Durjanpur (Vidisa, MP). The Rāmajanmabhūmi inscription of Ayodhya has evoked much interest, publicity and notoriety also due to politics but such discoveries must be critically evaluated and utilized soberly as

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historical source-material if it is proved to be genuine. Such examples could be multiplied. These new sources, evidences can be supplemented by references to the discovery of new coins, images and temples but the limits of this paper does not permit us to go further. However, the facts cited are adequate to establish that archaeology can provide new and fresh sources of information which may enlighten many dark corners and help solve problems of ancient Indian history.

CONCLUSION

To recapitulate and conclude, it may be said that sources of ancient India are of two types, literary and archaeological. Indian literary tradition—Vedic, Purāṇic, Epic, Chronicles—did have a historical tradition which was highly spiritual, having been based on India's vision of eternal time and spiritual man with *Karman* and *Dharman* as determining factors. As such, the empiricist historians of the European tradition will be disappointed not to find historical works of the Greek or Chinese type in the literature of ancient India. Sources of ancient history have to be evaluated in the light of the tradition of the region and supplemented and corroborated by external factors. Of the foreign literary sources, the Greek writings have to be studied keeping their North-west perspective in mind and with caution since their data were rarely direct and were not free from bias of ethnographic tradition and Greek orientation.

With better, improved texts and the appearance of new sources in technical subjects, the history of science in ancient India may now be written with greater confidence than before. The Buddhist and Jain literary corpus may also be used as a corrective to the idealistic and sometimes Brāhmaṇical-oriented accounts but the religious orientations of these works should also be taken into account before we reach any sound historical conclusion.

The literary sources have to be corroborated by archaeological sources—material remains, inscriptions, coins, art and architecture etc. There is urgent need of collaboration between historians and archaeologists, working with common, agreed models and clear-cut definitions of concepts and questions. With the availability of new techniques in archaeology—computers, marine archaeology, new dating methods, archaeo-metallurgical studies, chemical analysis and other interdisciplinary approaches, the writing of ancient Indian history, with the ever-growing corpus of evidence and sources has become an interesting though onerous and complicated exercise—the production of a history which is analytical, rational, objective and meaningful, and in harmony with the aims and ideals of the Indian tradition and the dreams and aspirations of modern India. Like the Vedas the history of India is ever-growing, dynamic, and full of a life which transcends the ephemeral even as it transforms itself in time.

NOTES

1. E.C. Sachau, *Alberuni's India*, II, p. 10. He writes: 'The Hindus do not pay much attention to the historical order of things, they are very careless in relating in chronological succession of things.' Cf. Winternitz, *History of Sanskrit Literature*, vol. II, p. 208.
2. A.K. Saran, quoted by G.C. Pande, *An Approach to Indian Culture and Civilization*, Varanasi, 1985, p. 129, fn 11.
3. G.C. Pande, op. cit., 1985, pp. 127-8.
4. Ibid., p. 130.
5. Ibid., p. 131, cf. *Arthaśāstra*, 1.3.2.
6. Abhinavagupta, *Abhinavabhāratī*, vol. I, pp. 53-4; *āgamīkārthāḥ karmaphalasambandhasvabhāvāḥ*, cf. Kasika on Pāṇini, 5.4.23, *Amarakośa*, 1.6.4., 2.7.12.
7. Pañcadaśi, 7.4.2-24.

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8. Keith, *History of Sanskrit Literature*, p. 145. For views of others on the absence of historical books, see U.N. Ghoshal, *Studies in Indian History and Culture*, S.N. Banerjee attributes it to destruction while K.M. Munshi thinks that the degraded events of the Kaliyuga were not considered as fit subjects for recording (*The Vedic Age*, Foreword).
9. For historicity of Vedic *Itihāsa Purāṇa* writings, see U.N. Ghoshal, op. cit.; A.K. Warder, *An Introduction to Indian Historiography;* for the Purāṇa's historicity, see Pargiter, *Ancient Indian Historical Tradition* and *Dynasties of the Kali Age*. For Chronicles see V.S. Pathak, *Ancient Historians of India*; V.S. Agrawal, R.C. Hazra, A.B.L. Awasthi, and S.N. Rai have also discussed socio-cultural history from the Purāṇas.
10. Romila, Thapar, *Ancient Indian Social History*, Orient Longman Ltd. 1979, p. 355.
11. Ibid., p. 281.
12. Ibid., p. 280.
13. G.C. Pande, op. cit., p. 129.
14. *Rājataraṅginī*, I.7—*Ślāghyaḥ sa eva Guṇavāna rāgadveṣa Bahiṣkṛtaḥ Bhūtārtha Kathane Yasya stheyaseva Saraswatī.*
15. Thapar, op. cit., p. 276.
16. Ibid., p. 277.
17. See R.S. Sharma, *Material Culture and Social Formation in Ancient India*, Delhi, 1983.
18. See R.N. Nandi, 'Ṛgvedic Samāja: Eka Punravicāra', in *Itihāsa* (in Hindi), ICHR, New Delhi, vol. 2, 1993, pp. 70-90.
19. H. von. Stiencron, *Indische Sonnenpriester, Sāmba und die Śākadvīpīya Brāhmaṇa*, Wiesbaden, 1966.
20. V.C. Srivastava, 'Two Distinct Groups of Indian Sun-Priests: An Appraisal', in *Purāṇa*, vol. XXX, no. 2, July 1988, pp. 109-20.
21. Klaus, Karttunen, *India in Early Greek Literature*, Helsinki, 1989, p. 7 ff.
22. Ibid., p. 231.
23. Ibid., p. 232.
24. Ibid.
25. For example U.P. Arora has done this type of study through his articles as in *Graeco-Arabia*, 1, pp. 131-40; *Makeoovika*, 12; and in different issues of *Yavanikā, Journal of the Indian Society for Greek and Roman Studies*, Bareilly.
26. Karttunen, op. cit., p. 133.
27. G.C. Pande, *Studies in Mahāyāna*, Sarnath, 1993, p. 2.
28. Ibid., p. vii.
29. Ibid., pp. vii-viii.
30. Romila Thapar, 'The Historian and Archaeology Data', in *Ancient Indian Social History*, 1979, p. 193.
31. Ibid.
32. F.R. Allchin and N. Hammond (eds.), *The Archaeology of Afghanistan*, London 1978. Cf. V.C. Srivastava, *The Protohistoric Afghanistan*, Varanasi, 1996.
33. Thapar, op. cit., p. 193.
34. Ibid., p. 195.
35. Such an approach has been adopted in Srivastava, op. cit., ch. IV.
36. Thapar, op. cit., p. 206.
37. R. Thapar, 'Purāṇic Lineages and Archaeological Cultures', *Purātattva*, vol. 8, 1975, pp. 86-98.
38. P.C. Pant, *Paisra*, Delhi, 1991.
39. See J.N. Pandey, *Purātattva Vimarṣa*, Allahabad, 3rd ed., 1991, pp. 207-306.
40. G.D. Possehl, 'Revolution in the Urban Revolution: The Emergence of Indus Civilization', in *Annual Review of Anthropology*, vol. 19, 1990, pp. 261-82.
41. H.P. Francfort, *Foulles De Shortughai: Recherches Sur L'Asia Centrale Protohistoric*, Paris, 1989, two vols.
42. See M.K. Dhavalikar, *Cultural Imperialism: Indus Civilization in Western India*, New Delhi, 1995.
43. R.S. Bisht, 'Dholavira: New Horizons of the Indus Civilization', in *Purātattva*, no. 20, 1989-90, p. 71 ff.
44. P. Singh, *Excavation at Narhan* (1984-89), Varanasi, 1994, Foreword.
45. See *Indian Archaeology: A Review*, 1987-88; 1988-89 and *Purātattva*, no. 19, 1988-89, pp. 1-5.
46. See *Indian Archaeology: A Review*, 1986 onwards.
47. For a brief but good summary of significant discoveries in the field of epigraphy, see Ajay Mitra Shastri, 'Fifty Years of Epigraphical Studies in India, A Brief Survey', in *Purātattva*, no. 25, 1994-95, pp. 21-39.

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CHAPTER II

Purāṇic Historiography of the Vedic Age

S.N. Roy

The question as to whether the Purāṇas can be treated as a genuine source of ancient Indian history in general and Vedic history in particular is a vexed one. It has been exercising the minds of scholars since the last quarter of the eighteenth century, when the Purāṇas were included among the desiderata of Indological studies. Generally speaking, there has been difference of opinion among scholars regarding the value of Purāṇic evidence for the projection of Vedic history. Thus, A.B. Keith is excessively sceptical about the historical value of the Purāṇas and is doubtful regarding the historicity of any event which is not explicitly mentioned in the *Ṛgveda*.[1] S.N. Pradhan has drawn our attention to several synchronisms and has attempted to identify Divodāsa Atithigva of the *Ṛgveda* with Divodāsa of the Purāṇa account, who lived in the period of Daśaratha, father of Rāma.[2] V.C. Bhattacharya observes that the set of traditions propagated by the Purāṇas is basically founded on the Vedic heritage.[3] D.D. Kosambi thinks that those kings of the traditional account of the Purāṇas not figuring in the genealogical lists of the *Ṛgveda* may be pre-Vedic.[4] A.S. Altekar shows that there is nothing unscientific or unhistorical in utilizing the Purāṇic data on the pre-Pāṇḍava period for reconstructing contemporary history, after taking all due precautions. Various pre-Bhārata dynasties mentioned in the Purāṇas are as real and historical as the Śiśunāgas, or the Mauryas or the Āndhras.[5] R.B. Pandey holds that the Purāṇic evidence is more trustworthy than the philological evidence and is corroborated by the Vedic tradition.[6] D.R. Mankad finds harmony in the midst of the apparent discrepancies in the various lists of names given in the Purāṇic records on the pre-Mahābhārata Solar dynasty.[7] P.L. Bhargava has attempted to reconstruct pre-Bhārata war history on the basis of agreement between the Vedic and Purāṇic traditions.[8]

Instead of multiplying the mention of names of scholars and their works on the subject further, it would be worthwhile here to point out that the reconstruction of Vedic history on the basis of the Purāṇa tradition will ever remain tentative and far from genuine history due to the obvious fact that the account in the Purāṇas was compiled from the remnants of Vedic lore during times when memories of actual events had become faint and far removed from historical accuracy. In evaluating the authenticity of the Purāṇic evidence for Vedic history we have to assess the validity of observations that there are hardly any points of contact between the Vedic and Purāṇic traditions and that the Purāṇic genealogies relate to the same persons as those figuring in the Vedic literature. At the very outset, it has to be admitted that we will be in error if we raise any doubt about the fact that there are a large number of cases where the Purāṇic genealogies can correctly be referred to kings who figure in the Vedic literature also. Some instances have been brought to light by A.S. Altekar, A.D. Pusalkar, F.E. Pargiter,

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Pradhan and others. In the present note, we examine such instances afresh, making necessary modifications and additions.

According to the Purāṇas there were three early kings in the Solar dynasty of Ayodhyā, namely, Prasenajit, his son Yauvanāśva and the latter's son Māndhātri. Māndhātā Yauvanāśva figures as a well-known emperor and a great performer of sacrifices. The *Vāyu* and *Brahmāṇḍa Purāṇas* give a *Nārāśaṁśī-Gāthā* account of the said king which begins thus—'Here are two verses about this ruler, which have been preserved by the Paurāṇika Brāhmaṇas'.[9] In this connection the Vedic text, *Copatha Brāhmaṇa* refers to a Brāhmaṇa named Vicāri Kabandha going to a sacrifice performed by a paramount king named Māndhātā Yauvanāśva and asking him some question there.[10] It is, therefore, evident that the Vedic text refers to the same king as figures as a great emperor and performer of sacrifices in the Purāṇas.

According to the *Vāyu Purāṇa* and the *Brahmāṇḍa Purāṇa*, in the same Solar dynasty of Ayodhyā mentioned above, there flourished a king named Trayyāruṇa. He had established a reputation for justice and fair play. It is narrated that he expelled even his own son, who had abducted the wife of the king of Vidarbha.[11] The text of the *Viṣṇu Purāṇa* relates the narrative somewhat differently. It says that Satyavrata, son of Trayyāruṇa, was degraded to the condition of a Cāṇḍāla outcaste.[12] The *Brahma Purāṇa* and *Harivaṁśa* detail his iniquity at length; and the story is told more concisely in the *Liṅga Purāṇa*. It is narrated there that Satyavrata carried off the betrothed of another man, one of the citizens according to the two former, of Vidarbha according to the latter: for this his father, on the advice of Vasiṣṭha, banished him and he took refuge with śvapākas.[13] A parent of the type described in this story, as Altekar notices, is available in the Vedic text, *Pañcaviṁśa Brāhmaṇa*, which narrates that there flourished in the Solar dynasty of Ayodhyā a king named Trayyāruṇa, son of Tridhātu. It is added that the king did not mind incurring the wrath of his family priest by expelling him for running over a child in the street.[14] As a consequence of the wrath of the expelled priest, the sacrificial fire would not ignite. The king managed to get over the difficult situation by inducing the priest to return. The priest then recited *Ṛgveda*, V.2.9, and let the fire be ignited.[15] Thus, there is no harm in accepting the view that Trayyāruṇa of the Purāṇas is identical with the king of the same name figuring in the *Pañcaviṁśa Brāhmaṇa*, as both belonged to the same dynasty and had fathers of the same name. Tridhātva of the Vedic text may not be taken as different from Tridhātu of the Purāṇa texts.

Next, we consider Hiraṇyanābha of the same dynasty. In this connection, Altekar quotes a passage of the *Viṣṇu Purāṇa* which describes him as a great *yogeśvara*. Yājñavalkya is stated to have studied yoga under him.[16] Altekar attempts to equate him with Hiraṇyanābha Kauśalya mentioned in the *Śāṅkhāyana Śrauta Sūtra*.[17] It is, however, noteworthy that the corresponding passages of the *Vāyu Purāṇa* and the *Brahmāṇḍa Purāṇa* are, in the present context, more relevant in the sense that, in both the texts, Hiraṇyanābha is designated as Hiraṇyanābha Kauśalya.[18]

In the dynasty which ruled over Vaiśālī, the most famous king was Marutta. Discontinuing its prosaic narrative, the *Viṣṇu Purāṇa* proceeds to describe in *Nārāśaṁśī-Gāthā* style that 'there never was beheld on earth a sacrifice equal to the sacrifice of Marutta'.[19] The *Vāyu Purāṇa* and the *Brahmāṇḍa Purāṇa* add that the sacrifice was conducted by Saṁvartta, whom the *Bhāgavata* terms a yogi, the son of Aṅgirasa; and narrates that Bṛhaspati was so jealous of the splendour of the rite that a great quarrel ensued between him and Saṁvartta. Consequently Marutta, with his kindred and friends was taken by Saṁvartta to heaven.[20] It is significant that, in all these texts, Marutta is stated to have been the son of Avikṣi or Avikṣita. Both these terms occur; as Citsukha, the commentator of *Viṣṇu Purāṇa* observes '*avikṣireva kvacidavikṣidityāpi*'. The proto-type Vedic account of the Purāṇa narrative is available in the *Aitareya Brāhmaṇa*. It also refers to King Marutta, son of Avikṣita, whose priest was Saṁvartta and who was very famous

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as an emperor and sacrificer.[21] Thus the reference of both the Purāṇic and Vedic traditions is to one and the same king.

In the *Vāyu Purāṇa*,[22] the *Brahmāṇḍa Purāṇa*[23] and the *Mahābhārata*;[24] there is reference to King Pratarddana of Vārāṇasī. It is narrated that he had been driven out of his capital by the Haihaya king of the Cedi country. Pratarddana, however, succeeded in regaining his kingdom by enlisting the help of the sage Bharadwāja. This narrative is available in a number of Vedic texts, including the *Pañcaviṁśa Brāhmaṇa*,[25] the *Kāṭhaka Saṁhitā*,[26] etc. These texts allude to the significance of Apratiratha ritual which enables one to conquer his enemies and also add that, it enabled sage Bharadwāja to win back the kingdom for his patron, King Pratarddana.[27]

There is a reference to King Babhru in the text of the *Viṣṇu Purāṇa*. He is stated to have been a son of Devavṛdha of the Yadu dynasty. While eulogizing the valour and prowess of Babhru, the text of the *Viṣṇu Purāṇa* breaks its prosaic account and continues its narrative in *Nārāśaṁsī-gāthā* style, with a verse that runs, 'we hear when afar, and we behold when nigh, that Babhru is the first of men, and Devavṛdha is equal to the gods; sixty-six persons following the precepts of one, and six thousand eight who were disciples of the other, obtained immortality.[28] The corresponding Vedic account is available in the *Aitareya Brāhmaṇa*,[29] which narrates that King Babhru, son of Devavṛdha became a great king, by virtue of the mysterious efficacy of a certain ritual.

In the Purāṇa tradition, the Śakuntalā episode occupies a position of supreme importance. It occurs in a number of Purāṇas including the *Viṣṇu*,[30] *Vāyu*,[31] *Matsya*,[32] and *Bhāgavata*.[33] In all these texts, Bharata is described as son of Duṣyanta of the Paurava lineage. The *Viṣṇu Purāṇa* quotes a verse explanatory of Bharata's name. It runs thus:

> The mother is only the receptacle; it is by the father by whom a son is begotten. Cherish thy son Duṣyanta; treat not Sakuntalā with disrespect. Sons born from the paternal lions, rescue their progenitor from the infernal regions. Thou art the parent of this boy; Śakuntalā has spoken the truth.

From the expression 'cherish', '*bharaswa*' the prince was called Bharata. Wilson thinks that these two ślokas are taken from the *Mahābhārata*, Ādi Parvan, and are part of the testimony borne by a heavenly message to the birth of Bharata. They are repeated in the same book, in the account of the family of Puru. They occur, with slight variation of the order, in other Purāṇas, such as the *Vāyu*, and show the greater antiquity of the story of Śakuntalā, although they do not narrate it. The meaning of the name Bharata is differently explained. He is so called from 'supporting' the world; he is also known as 'Sarvadamana', 'the conqueror of all'.[34] It is significant that the kernel of this episode is traceable in the gāthās quoted in the Brāhmaṇa texts, such as the *Aitareya Brāhmaṇa*[35] and *Śatapatha Brāhmaṇa*.[36] The gāthā in the *Aitareya Brāhmaṇa* calls Bharata 'Dauṣyanti', while that in the *Śatapatha Brāhmaṇa* designates him 'Saudyumni'. Probably Duṣyanta and Sudyumna refer to one and the same person.

The story of the love-affair of Purūravas and Urvaśī figures prominently in the Purāṇa texts, including the *Viṣṇu, Vāyu, Matsya, Vāmana, Padma* and *Bhāgavata*. It is told in the same strain, though with some variations, and in greater or less detail. Amongst the Vedic texts, it is the *Śatapatha Brāhmaṇa* which refers to the Purūravas-Urvaśī story.[37] There is a remarkable similarity in several details of the story in both the Vedic and Purāṇic traditions.[38]

Attention may now be drawn to the Purāṇic explanation of the origin of the name of Pañcāla for the country. In this connection, Altekar quotes a passage of the *Vāyu Purāṇa*,[39] which shows that Pañcāla was a new name applied to the country some generations before the Bhārata war.[40] Other Purāṇa texts give some more interesting details. According to the *Viṣṇu Purāṇa*, Haryyāva of the Puru line had five sons, namely Mudgala, Śrīñjaya (mentioned as Jaya in the *Matsya*, Sañjaya in the *Bhāgavata*), Vṛhadiṣu, Pravīra (mentioned as Yavīnara in the *Agni*

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and *Bhāgavata* and as Javīnara in the *Matsya*), and Kāmpilya (mentioned as Kapila in the *Matsya* and Krimilāśva in the *Brahma*). The text of the *Viṣṇu Purāṇa* narrates that their father had said, 'these my five (*pañca*) sons are capable (*alam*) of protecting the countries and hence they were termed as *pañcālas*'. The Purāṇic account, in its essential aspects, is confirmed by the *Śatapatha Brāhmaṇa*. The latter text takes us back to five generations earlier, to the reign of Ajamīḍha and narrates that, on his death, the realm was divided among his three sons, the main capital being at Hastināpura, and the two others in the Krivi country, later name Pañcāla.[41] Altekar suggests the possibility of a connection of Krivis with Prince Krimilāśva of the Purāṇas.[42] According to Pargiter, Krivi has nothing to do with Kuru, for King Kuru came considerably later.[43] Wilson remarks that Pañcāla at first covered the country north and west of Delhi, between the foot of the Himalayas and the river Chambal. It was later divided into northern and southern Pañcāla, separated by the Gaṅgā.[44]

The Purāṇas narrate that Pratīpa, who flourished in the Kuru family, had three sons, namely, Devāpi, Śāntanu and Bāhlīka. Regarding Devāpi, the *Viṣṇu Purāṇa* narrates that he adopted a forest life in childhood and that Śāntanu became king.[45] The *Matsya Purāṇa* account is slightly different. It relates that Devāpi was leprous and, on that account, his subjects condemned him. Consequently, he was set aside in favour of his brother Śāntanu. It also adds that Devāpi became a priest and performed a sacrifice for his brother Śāntanu. Subsequently, rains poured down on the realm.[46] Coming to the Vedic tradition, we find that the Bṛhaddevatā[47] expressly declares that Devāpi Ārisṭasena was a brother of Śāntanu Kaurvya. In this connection, Altekar quotes a significant passage from the *Ṛgveda*, which narrates that Devāpi officiated at Śāntanu's sacrifice and brought down rains from the sky.[48]

In the Kuru lineage, the Purāṇas refer to Dhṛtarāṣṭra, son of Vicitravīrya. With regard to the details of Dhṛtarāṣṭra and his descendants, the Purāṇas generally concur and seem to have drawn upon the same source, i.e., the Ādiparvan of *Mahābhārata*. Sometimes, there are variations of minor significance.[49] The same Dhṛtarāṣṭra, son of Vicitravīrya, is mentioned as a king of Kuru-pāñcāla in the Vedic text, *Kāṭhaka Saṁhitā*.[50]

The *Matsya Purāṇa*,[51] the *Bhāgavata Purāṇa*,[52] and the *Padma Purāṇa*[53] refer to an early king of Kāśī named Śunahotra. It is narrated that he had a younger son, Gṛtsamada, who became a great Vedic sage along with *his* (Gṛtsamadas) son Śaunaka. The Purāṇic account is consistent with the Vedic tradition. As shown by Altekar, the second maṇḍala of the *Ṛgveda* is assigned to Gṛtsamada and internal evidence tends to show that Śunahotra was his father or ancestor.[54]

The *Viṣṇu Purāṇa* mentions the sage Atri. It is narrated that he was the son of Brahmā, the creator of the universe, who sprang from the lotus that grew from the navel of Nārāyaṇa. The son of Atri was Soma, i.e. moon, whom Brahmā installed as the sovereign of plants, the Brāhmaṇas and the stars.[55] The narrative runs slightly differently in other Purāṇas. Thus the *Vāyu Purāṇa*[56] and the *Brahmāṇḍa Purāṇa*[57] relate that the essence of Soma (*Somatva*) issued from the eyes of Atri and impregnated the Quarters. The *Brahma Purāṇa* gives a special name to the effusion and credits the sage with the feat of restoring light to the universe by killing the demon Svarbhānu who had overpowered the Sun.[58] The *Viṣṇu Purāṇa* refers to Svarbhānu as a powerful demon and son of Kaśyapa by Danu.[59] Altekar notes that the Atri-Svarbhānu legend seems to owe its origin to Atri's astronomical skill in anticipating the occurrence and duration of a solar eclipse. The legend finds its confirmation in the *Kauśītaki Brāhmaṇa* in all its important particulars.[60] Pargiter draws our attention to the detailed account of the mythical sage Atri. The name is loosely applied to various Ātreyas.[61] He is considered to be the third Prajāpati in the *Brahmāṇḍa*,[62] *Vāyu*[63] and *Liṅga*.[64] In all these texts, there is a common genealogy of the Ātreyas. On the other hand, in the *Brahma Purāṇa*[65] and *Harivaṁśa*[66] they are related to the Paurava lineage. In the *Viṣṇu Purāṇa*[67] and the *Matsya Purāṇa*,[68] Atri is mentioned as the son-in-law of Ṛiceyu (Ṛiteyu in the *Viṣṇu Purāṇa*), an early king in the

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dynasty, and the Kaṇvas are represented as descendants of a later king, Ajamīḍha, through his wife Keśinī.[69] Though the Purāṇic details regarding the Ātreyas are jumbled up, yet in the fundamental aspects there is unity in the account. In this connection, Altekar draws our attention to the Ṛgvedic evidence, establishing similarity in the Vedic and Purāṇic traditions on the present issue. Thus, in one of the passages of the *Ṛgveda*,[70] Atris seem to have been closely connected with the Kaṇvas. Another passage[71] represents descendants of Ajamīḍha as priests and singers.

The Purāṇas refer to Vibhāṇḍaka of the lineage of sage Kaśyapa. He had his hermitage on the bank of river Kauśikī (identifiable with the modern Kośi of northern Bihar). His son was sage Ṛṣyaśriṅga. The king of Aṅga, Lomapāda, in whose territory Ṛṣyaśriṅga lived, inveigled the latter to his capital to bring down rains after a long drought.[72] The Purāṇas also refer to Vaibhāṇḍakī, who was eventually a descendant of Vibhāṇḍaka. He is connected with Lomapāda's fourth successor, Haryaṅga.[73] In this connection, the Purāṇic account is confirmed by the Vedic tradition recorded in the *Vaṁśa Brāhmaṇa*, which narrates that Vibhāṇḍaka happened to be a pupil of Ṛṣyaśriṅga.[74]

The *Vāyu Purāṇa*,[75] *Brahmāṇḍa Purāṇa*,[76] *Harivaṁśa*,[77] *Brahma Purāṇa*[78] and *Liṅga Purāṇa*[79] relate that Janamejaya II, injured the ṛṣi Gārgya's son and was therefore cursed by Gārgya. Consequently, he was abandoned by his people and suffered great affliction. He sought help from Sage Indrota Daivāpi Śaunaka, who purified him through a horse-sacrifice.[80] Altekar traces the prototype of this episode in the *Śatapatha Brāhmaṇa*.[81] It is, however, noteworthy that the present episode is confirmed also by the *Śāṅkhāyana Śrauta Sūtra*[82] in each of its details.

The legend of Śunaḥśepa occurs in a number of texts along with variations in its details. Thus, the *Ṛgveda* describes Śunaḥśepa as the author of various Sūktas. He is also called the son of Ajīgartta. As regards the Purāṇa tradition, attention may be drawn to the text of the *Viṣṇu Purāṇa* which relates that Viśvāmitra flourished in the lineage of Sage Bhṛgu and his son was Śunaḥśepa.[83] The *Bhāgavata Purāṇa* depicts the legend in greater detail, which tallies with the *Mahābhārata* account in its essential aspects.[84] These texts refer to Triśaṅku, who was succeeded by his son Hariścandra to the throne of Ayodhyā. His son was Rohita. Viśvāmitra and Jamadāgni attended as priests at the sacrifice at which Śunaḥśepa was substituted for Rohita. It is significant that most of these details are traceable in the Vedic texts like the *Aitareya Brāhmaṇa*[85] and *Śāṅkhāyana Śrauta Sūtra*.[86]

In no less than eight Purāṇas, namely the *Vāyu*,[87] *Matsya*,[88] *Harivaṁśa*,[89] *Brahma*,[90] *Viṣṇu*,[91] *Agni*,[92] *Garuḍa*,[93] and *Bhāgavata*,[94] there is reference to the dynasty, which reigned in north Pañcāla. Some important members of this dynasty are mentioned as Mudgala, Indrasenā, Vadhrayāśva, Divodāsa, Śrīñjaya, Cyavana (or Pāñcajanya) and Śudāsa. In this connection, Pargiter rightly contends that the Purāṇic account finds confirmation in the Vedic texts.[95] Thus Mudgala is mentioned in *Ṛgveda* X.102, 5, 9; Indrasenā in verse 2, Vadhrayāśva is supposed to be hinted at by the words Vadhriṇā Yujā in verse 12. His name is expressly mentioned in *Ṛgveda*, x.69.lf. and in VI.61.1. The latter hymn relates that Divodāsa was son of Vadhrayāśva. Śrīñjaya is mentioned in *Ṛgveda* IV.15.4. Cyavana (or Pāñcajanya) is mentioned in *Ṛgveda* X.69.5-6. His son Śudāsa is named as Śudāsa Paijavana in *Ṛgveda*, VII.28.22-23, while verse 25 of the same says that Śudāsa was a son (i.e., descendant) of Divodāsa. *Aitareya Brāhmaṇa*, VII.34 mentions that Sahadeva was descended from Śrīñjaya. Somaka is stated to have been his son in *Ṛgveda*, IV.15.7-10. *Ṛgveda*, III.53, 9, 11, 12, 24 and VI.16, 19 relate that Divodāsa and Śudāsa were descendants of Bharata. Of the above list the name of Śudāsa is of special note. He figures as the hero of the famous dāsarājña war of the *Ṛgveda*. As noted above, in the Purāṇic account Śudāsa is stated to have flourished as a member of the North Pañcāla dynasty. It is related that he drove the Paurava king, Saṁvaraṇa of Hastināpura, out, defeating him on the banks of the river Yamunā. His

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conquests stirred up a confederacy of the neighbouring kingdoms to resist him. The confederacy included Puru (Saṁvaraṇa), the Yādavas (the Yādava king of Mathurā), the Śivas (Śivis, who were Ānavas), Druhyus (of Gandhāra), Matsya (west of Śūrasena), Turuvasa (the Turuvasu prince) and four others of minor states. It is narrated that Śudāsa defeated them in a great battle near the river Paruṣṇi (Ravi) and, consequently, Puru Saṁvaraṇa fled and took refuge in a fortress near the river Sindhu. Altekar detects a reference to the dāsarājña war in the *Mahābhārata* also in the description it gives of the sad lot of the Paurava family at the time of king Saṁvaraṇa.[96] The epic account alludes to the great slaughter of the people and the reverses of the Purus in various ways. The whole nation was shattered. The Bharatas were attacked by enemies in immense numbers. The Pañcāla king invaded the country with a great force, and the Kuru king had to flee to the west along with his ministers, family and allies. Ultimately, the Purus found asylum somewhere on the banks of the Indus. They then requested Sage Vasiṣṭha to become their *purohita* and bless and help their efforts to regain their dominions. Vasiṣṭha agreed, gave the Puru king *sāmrājyābhiṣeka*, and the Purus were eventually successful in regaining their kingdom.[97] A.D. Pusalker observes that the war of Saṁvaraṇa may be said to be the Purāṇic account of the Vedic dāsarājña and that the Vedic description of the battle is more reliable than the epic or Purāṇic accounts.[98] He also attempts to establish the identity of the Vedic Kuruśravaṇa with the Purāṇic Kuru, son of Saṁvaraṇa.[99]

It may again be asserted that there is no harm in endorsing the view[100] that the various dynasties like the Purus, Yadus, Druhyus etc., that the Purāṇas unanimously declare to have ruled before the Bhārata war, were historic ruling families of the period, holding sway in territories indicated by the texts. One can hardly deny that there are many lacunae in these genealogies. But the Purāṇas are conscious of them in many cases. One striking instance is traceable in a passage from the *Viṣṇu Purāṇa*.[101] According to the Purāṇic narrative Revatī, wife of Balarāma, was a daughter of King Raivata, who flourished about ninety generations before his son-in-law. The Purāṇa authors were quick to realize that this was a case of an impossible marriage. They therefore, tried to explain this wedlock in an interesting and characteristic way. According to the narrative Raivata went to heaven to consult Brahmadeva about the selection of a proper bridegroom for his daughter Revatī. During his stay in heaven he forgot his mission, being enchanted by the celestial music, which he went on listening to for many ages. But, we cannot, merely on that account, dismiss these characters as being totally fictitious.

CONCLUSION

Before closing our note on the present state of Purāṇic studies, we may again point out that it is not a convenient or comfortable observation that there are hardly any points of contact between the Vedic and Purāṇic traditions. The actual state of affairs cannot be brought to the fore without an impartial examination of the age-old traditions preserved in the extant Purāṇas *vis-à-vis* the Vedic texts. If carefully examined, setting aside all preconceived notions, the Purāṇic allusions to the kings and sages do not appear to be independent of the Vedic accounts. We have cited above a number of such cases. Hereafter, we are listing some more cases of the same category. As noticed by the authors of the *Vedic Index*,[102] Yayāti figures in the *Ṛgveda* as an ancient sacrificer. Besides, he is also stated to have been a son of Nahuṣa and a seer of some hymns. On the other hand, in the Purāṇas as well as in the epic accounts, he is connected with the Lunar dynasty, as also with the Purus, Anus, Druhyus, Yadus and Turavasus. Keith and Macdonnell point to the 'inaccuracy' of this account. This remark is hardly justifiable. As in the *Ṛgveda*, in the Purāṇic account, too, Yayāti is said to

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have been a son of Nahuṣa,[103] Yadu and Turvasu were his sons, born of Devayānī, while Druhyu and Puru were born of Śarmiṣṭhā. These details bring out that there is a strong agreement between the two traditions, as far as fundamental aspects are concerned. The names of the sons of Yayāti are also mentioned in the *Ṛgveda* as ancient tribes. It would be a futile exercise, as Pusalker[104] would like to put it, to seek an connection between the Vedic Puru and Purāṇic Purukutsa. A comparative study of the Vedic and Purāṇic texts reveals that there were two Purukutsas[105] with sons named Trāsadasyu. In the Purāṇas,[106] both Purukutsa and his son Trāsadasyu are referred to as kings of Ayodhyā. Reference to this effect is also available in the *Śatapatha Brāhmaṇa.*[107] According to the authors of the *Vedic Index,*[108] the Purukutsas in the *Ṛgveda* were apparently Puru kings, while Pargiter[109] contends that they probably belonged to some minor dynasty descended from Bharata and are unknown to Kṣatriya fame. There was no Ikṣavāku line of Puru princes.

It would not be against the spirit of the present note, before its final conclusion, if we were to reconsider the case of Vedic Pañcajanas. Pusalker appears to be a little hesitant to assert that the five tribes, namely the Yadus, Turvasas, Anus, Druhyus and Purus represent the Vedic Pañcajanas.[110] The fact, however, should not be overlooked that these five tribes, as descendants of Yayāti, are so mentioned at a number of places in the *Ṛgveda.*[111] Zimmer rightly contends that these five are 'five peoples' (*pañcajanāḥ*) of the *Ṛgveda.* The Vedic account finds full expression in the Purāṇa tradition preserved in the extant texts of *Vāyu,*[112] *Brahmāṇḍa,*[113] *Harivaṁśa,*[114] *Liṅga,*[115] *Kūrma*[116] and *Brahma.*[117] These texts narrate that the five races descended from Yayāti, namely the Yādavas, Turvasus, Ānavas, Druhyus and Pauravas, spread over the entire earth. This original connotation of the word *pañcajana* has undergone strang changes, both in early as well as later texts. Thus, the *Aitareya Brāhmaṇa* takes the 'five' to be the gods, men, *gandharvas* and *apsarās,* snakes and fathers. Yāska holds that *pañca* (five) refers to *gandharvas,* fathers, gods, *asuras,* and *rākṣasas.* Aupamanyavas and Sāyaṇa hold that the four varṇas and the Niṣādas made up the five.[118] The *Bhāgavata Purāṇa* and the *Padma Purāṇa* take pāñcajanya in the sense of an island, along with Swarṇapatha, Candraśukla, Avarttana, Ramaṇaka, Mandahara, Siṅhala and Laṅkā.[119] According to the *Viṣṇu Purāṇa, Pañcajana* was a demon living in the form of a conch shell. When Kṛṣṇa came to know of it, he plunged into the sea and, having slain the vile Pañcajana, he carried away the conch-shell.[120]

On the basis of the notes and observations detailed above we may reasonably reach the following conclusions:

(a) The genealogical lists preserved in the copies of the extant Purāṇas can well be utilized for the reconstruction of Vedic history.
(b) Some Purāṇic kings, like Ambarīśa, Ṛtuparṇa, Pṛṣadhra, Bṛhaduktha, Purumīḍha, Devātithi and Vātāpi, appear in Vedic literature also, but we have no cogent data to prove their identity. The equations may or may not be established.
(c) Vedic kings not mentioned in the Purāṇas possibly belonged to minor dynasties, or the same person might have been known under different names in the Vedic and Purāṇic texts.
(d) The so-called discrepancies between the Purāṇic and Vedic accounts are more apparent than real. Such discrepancies are not hard to reconcile if they are analysed in a correct historical perspective.
(e) The fact has to be borne in mind that the Vedic texts and Purāṇa texts were produced under different circumstances, with different aims and objects. Consequently, some differences in their accounts are inevitable. This phenomenon, however, does not adversely affect the comparative value of the two traditions.

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NOTES

1. *Journal of the Royal Asiatic Society of Great Britain and Ireland*, London, 1914, pp. 118-26.
2. *Chronology of Ancient India*, Calcutta, 1927.
3. *Journal of the Ganganath Jha Research Institute*, XV, pp. 109-33.
4. *Indica*, pp. 196-214.
5. *Journal of the Banaras Hindu University*, IV, pp. 183-220; *Proceedings of the Indian History Congress*, III, pp. 33-77.
6. *Indian Historical Quarterly*, XXIV, pp. 94-103; *Proceedings of the Indian History Congress*, X, pp. 128-37.
7. *Bhāratīya Vidyā*, III, pp. 160-70.
8. *India in the Vedic Age*, Lucknow, 1956.
9. *athāpyudāharantīmau ślokau pauraṇika dvijāḥ/*
   yāvatsūrya udayati Yāvaccha pratitiṣṭhati//
   sarvaṁ tadyaunāśvasya māndhātuḥ kṣetra ucyate/
   atrapyudarantīmaṁ ślokaṁ vaṁśavido janāḥ Yaunāśvam mahātmānaṁ Yajvānamitaujasam//
   —*Vāyu Purāṇa*, 88, 66-7; *Brahmāṇḍa Purāṇa*, III, 63, 68-9.
10. *sa māndhāturyaunāśvasya sarvabhaumasya rajñḥ somam prasūtamājagāma; sa sado' nupraviśya ṛtvijam ca yajamānam cāsaṅtrāsayāmasa—Gopatha Brāhmaṇa*, II.9.
11. tasya putro' abhavadrājā tridhanvā nāma dhārmikaḥ/
    āsīt-tridhanvā cāpi vidvāṅstrayyāṁ-raṇaprabhuḥ//
    tasya satyavrato nāma kumāro' bhūnmahābalaḥ/
    tena bhāryā vidarbhasya hṛtā hatvā divaukasaḥ//
    tamadharmeṇa saṁyuktam pitā trayiguṇo' tyajat//
    —*Vāyu Purāṇa*, 88, 77-88, 81; *Brahmāṇḍa Purāṇa*, II.63.76-7, 79.
12. *Viṣṇu Purāṇa*, IV.4.
13. In this connection, H.H. Wilson draws our attention to the *Rāmāyaṇa* which tells a different story. It ascribes Triśaṅku's degradation to the curse of the sons of Vasiṣṭha, to whom the king had applied to conduct his sacrifice, after their father had refused to do so. Before that, he is described as a pious prince (*satyavādī jitendriyaḥ*) and the object of his sacrifice was to ascend the heaven
    —*Translation of Viṣṇu Purāṇa*, p. 297, n. 7.
14. *vṛśo vai rājanyasya trayyāruṇasya traidhātvasyaikṣvākasya purohita āsa—Pañcaviṁśa Brāhmaṇa*, XII, 3.12.
15. *Bṛhaddevatā*, V.14-23.
16. *hiraṇyanābho mahāyogeśvaraḥ jaiminiśiṣyaḥ, yato Yājñavalkyo Yogamavāpa—Viṣṇu Purāṇa*, IV, 4.48.
17. *Śāṅkhāyana Śrauta Sūtra*, XVI, 9.13.
18. *hiraṇyanābhaḥ kauśalyo vasiṣṭhaststsuto' bhavat, pautrasya jaimineḥ śiṣyaḥ smṛtaḥ sarveṣuśarmasu, śatāni saṁhitanāmtu pañca yo' dhītavaṁśtataḥ, tasmādadhigato yogo Yājñavalkyena dhīmatā*
    —*Vāyu Purāṇa*, 88, 206-7; *Brahmāṇḍa Purāṇa*, III. 64, 207-8.
19. *Viṣṇu Purāṇa*, IV.2.
20. Wilson draws our attention to the evidence of *Mārkaṇḍeya Purāṇa*, which relates that Marutta was so named from the paternal benediction, 'May the winds be thine', or 'be propitious to the' (*maruttava*). Ibid., p. 282, n. 20.
21. *etena ha vai aindreṇa mahābhiṣekeṇa saṁvartta aṅgiraso maruttamavikṣitamabhiṣiṣeca*
    —*Aitareya Brāhmaṇa*, VIII.21.
22. *Vāyu Purāṇa*, 91, 64-5.
23. *Brahmāṇḍa Purāṇa*, III.67, 62-9.
24. *Mahābhārata*, XIII.30, 29-30.
25. *Pañcaviṁśa Brāhmaṇa*, XV, 3.7.
26. *Kāṭhaka Saṁhitā*, XXI.10.
27. *athaitadapratiratham, etena ha sma vai bharadwājaḥ pratarddanam sannahyannabhyeti tato ha sa vai rāṣṭramanavat.*
28. *Viṣṇu Purāṇa*, IV.13.
29. *Aitareya Brāhmaṇa*, VII.14.
30. *Viṣṇu Purāṇa*, IV.19.2-8.
31. *Vāyu Purāṇa*, 99, 34-158.
32. *Matsya Purāṇa*, 49.11.33.
33. *Bhāgavata Purāṇa*, IX.20, 21-32.
34. H.H. Wilson, op. cit., p. 358, n.14.

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35. *Aitareya Brāhmaṇa*, VIII, 3.
36. *Śatapatha Brāhmaṇa*, XIII, 5.4.12.
37. Ibid., XI, 5.4.
38. For details see M. Winternitz, *History of Indian Literature*, vol. I, p. 530.
39. *Vāyu Purāṇa*, 99.198.
40. *pañcānām viddhi pañcaitān sphītā janapadā yutā/*
alaṁ saṁrakṣaṇe teṣām pañcālā iti viśrutāḥ//
41. *Śatapatha Brāhmaṇa*, XIII, 5.4.7; *krivaya iti purā pañcalānācakṣate.*
42. Altekar, op. cit., p. 48, n. 27.
43. F.E. Pargiter, *Ancient Indian Historical Tradition*, p. 274, n.3.
44. H.H. Wilson, op. cit., p. 363, n.49.
45. *Viṣṇu Purāṇa*, IV. 20.
46. *Matsya Purāṇa*, 50, 39-41.
47. *Bṛhaddevatā*, VII.155; VIII.5.
48. *Ṛgveda*, X, 98.5; Altekar, op. cit., p. 48.
49. *Viṣṇu Purāṇa*, IV, 21.
50. *Kāṭhaka Saṁhitā*, X.6.
51. *Matsya Purāṇa*, 195, 44-5.
52. *Bhāgavata Purāṇa*, IX, 17.3
53. *Padma Purāṇa*, V.1.11.
54. Altekar, op. cit., p. 49; *ayam te Śunahotreṣu soma indra tvāyā parityakto madāya; Ṛgveda*, II, 41,14.
55. *Viṣṇu Purāṇa*, I.6.
56. *tatrātri sarvalokānām tasthau svenojasāvṛtaḥ/*
somatvam tanurāpede mahābuddhiḥ sa vai dwijaḥ/
netrābhyāmastravatsomo daśadhā dyotayan diśaḥ/
—*Vāyu Purāṇa*, 90, 1-11, 46-7; *Brahmāṇḍa Purāṇa*, III,65,1-11.
57. Ibid.
58 *svarbhānunā hate sūrye patamāne divo mahīm/*
tamo' bhibhute loke prabhā yena pravartitā//—Brahma Purāṇa, 13.9.
59. *Viṣṇu Purāṇa*, III.21.
60. *svarbhānurhāsura ādtiyaṁ tamasāvidhyāt, tasyāstra—Yastamo' pajighāṁsta—Kauśītaki Brāhmaṇa*, 24.3.
61. F.E. Pargiter, op. cit., p. 228.
62. *Brahmāṇḍa Purāṇa*, III, 8, 73-86.
63. *Vāyu Purāṇa*, 70,67-78.
64. *Liṅga Purāṇa*, I, 63,68-78.
65. *Brahma Purāṇa*, 13, 5-14.
66. *Harivaṁśa*, 31,1658, 1661-8.
67. *Viṣṇu Purāṇa*, III,19.
68. *Matsya Purāṇa*, 49.16.
69. *ajamīḍhasca keśinyām kaṇvaḥ samabhavat kila, medhātithiḥ sutastasya tasmāt kāṇvāyanāḥ dwijāḥ*
—*Matsya Purāṇa*, 49,16.
70. *priyamedhavadatrivajjātavedo virūpavat, aṅgirastvanmahīvrata praskaṇvasya śrudhī havam—Ṛgveda*, I.45.3.
71. *Ṛgveda*, IV. 44.6.
72. *Viṣṇu Purāṇa*, IV. 18.3; *Vāyu Purāṇa*, 99.104; *Matsya Purāṇa*, 48, 95-6, *Brahma Purāṇa*, 13.41.
73. *Brahma Purāṇa*, 13.44; *Matsya Purāṇa*, 48.95-6.
74. In this connection, Altekar quotes a passage form the *Matsya Purāṇa*, which describes how Vibhāṇḍaka officiated as a priest for King Haryaṅga of the Ānava dynasty, who was two generations junior to Ṛṣyaśriṅga. Altekar, op. cit., p.50; *Matsya Purāṇa*, 48,98.
75. *Vāyu Purāṇa*, 93, 21-6.
76. *Brahmāṇḍa Purāṇa*, III.68, 20-6.
77. *Harivaṁśa*, 30.1608-13.
78. *Brahma Purāṇa*, 12, 9-15.
79. *Liṅga Purāṇa*, 66.71-7.
80. *gārgyasya hi sutaṁ bālaṁ sa rājā janamejayaḥ/*
durbuddhirhiṁsayāmasa lohagandhī naradhipaḥ/
sa lohagandhī rājarṣiḥ paridhāvannitastaḥ/
paurajānapadaistyakto na lebhe śarma karhicit/
tataḥ sa duḥkhasantapto nālabhatsamvidam kvacit/

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sa prāyācchaunakamṛṣīm śaraṇam Vyathitastadā/
indroto nāma vikhyato Yo'sau munirudāradhīḥ/
Yojayāmāsa cendrotaḥ śaunako janamejayam/
aśvamedhena rājanam pavanārtham dwijottamāḥ.

81. *etena haindroto daivāpaḥ janamejayam parīkṣitam yājayāñcakāra/*
tena ha sarvām pāpakṛtyām sarvām brahmahatyāmapajaghān/—Śatapatha Brāhmaṇa, XIII, 5,4,1.
82. *Śāṅkhāyana Śrauta Sūtra,* XVI, 9.7.
83. *Viṣṇu Purāṇa,* III.7.
84. *Bhāgavata Purāṇa,* IX.7, 7-25; *Mahābhārata,* I.61,62.
85. *Aitareya Brāhmaṇa,* VII, 3, 1 f.
86. *Śāṅkhāyana Śrauta Sūtra,* XV, 17-25. For details see *Journal of the Royal Asiatic Society of Great Britain and Ireland,* London, 1917, pp. 40, 44ff; Altekar, op. cit., p. 51.
87. *Vāyu Purāṇa,* 99, 194-211.
88. *Matsya Purāṇa,* 50, 1-16.
89. *Harivaṁśa,* 32, 1777-94.
90. *Brahma Purāṇa,* 13, 93-101.
91. *Viṣṇu Purāṇa,* IV. 19, 15-18.
92. *Agni Purāṇa,* 277, 18-25.
93. *Garuḍa Purāṇa,* I. 140, 17-24.
94. *Bhāgavata Purāṇa,* IX. 21, 30.
95. F.E. Pargiter, op. cit., p. 120.
96. Altekar, op. cit., p.51.
97. *ārkṣe saṁvaraṇe rājan praśāsati vasundharām/ sankṣayaḥ sumahānāsit prajānāmitinaḥ śrutam//*
Vyaśīryata tato rāṣṭram kṣayairnānāvidhaistadā/ abhyaghnan bharatāścaiva sapatatnānāṁ balāni ca//
—Mahābhārata, 1, 101, 23 ff.
98. *Bhāratīya Vidyā,* V, pp. 70-9.
99. Ibid., II, pp. 72-6.
100. *Viṣṇu Purāṇa,* IV, 1, 21.
101. Ibid.
102. *Vedic Index,* II, p. 187.
103. *Viṣṇu Purāṇa,* IV, 10.
104. *Vedic Age,* p. 311.
105. Pargiter, op. cit., p. 133 ff.
106. *Vāyu Purāṇa,* 88, 74; *Brahmāṇḍa Purāṇa,* III. 63, 73; *Kūrma Purāṇa,* 1, 20, 27-8.
107. *Śatapatha Brāhmaṇa,* XIII, 5, 4.5.
108. *Vedic Index,* I, p. 327.
109. Pargiter, op. cit., pp. 134.
110. *Vedic Age,* p. 310.
111. For example, I, 7, 9; IV, 14.4; 46, 7; IX.65. 2-3; X. 45, 6.
112. *Vāyu Purāṇa,* 93, 103; 99, 462.
103. *Brahmāṇḍa Purāṇa,* III, 68, 105-6.
114. *Harivaṁśa,* 30, 16, 20.
115. *Liṅga Purāṇa,* I.67, 26.
116. *Kūrma Purāṇa,* I, 21.5-6.
117. *Brahma Purāṇa,* 12, 20-21.
118. *Vedic Age,* p. 267, n.15.
119. H.H. Wilson, op. cit., p. 142, n. 3.
120. *Viṣṇu Purāṇa,* V.24.

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APPENDIX A

On the Identification of King Parīkṣit of the Vedic and Purāṇic Traditions

The question as to whether there was really a king named Parīkṣit, has ever been an important issue in Purāṇic studies. In this connection, Raychaudhuri comments that, although Parīkṣit is mentioned in both epic and Purāṇic accounts, the mere mention of a king in this kind of literature is no proof of his historicity, unless we have corroborative evidence from external sources.[1] By the expression 'external sources', Raychaudhuri obviously means Vedic sources. We may start with the information supplied by the *Matsya Purāṇa*. The text relates that 'Abhimanyu's son was Parīkṣit, the conqueror of his enemy's city. Parīkṣit's son was Janamejaya, who was very righteous.'[2] From the *Mahābhārata* we learn that Janamejaya had three brothers, namely Śrutasena, Ugrasena and Bhīmasena.[3] Similarly, the collated text suggested by Pargiter makes Śrutasena, Ugrasena and Bhīmasena brothers of Janamejaya.[4] This is contradicted not only by the epic account, but also by the account available in the text of the *Viṣṇu Purāṇa*, which says that Parīkṣit was a son of Abhimanyu and that his sons were Janamejaya, Śrutasena, Ugrasena and Bhīmasena.[5] In this context, Purāṇic tradition is confirmed by Vedic tradition, which reveals that Parīkṣit had four sons, namely Janamejaya, Ugrasena, Bhīmasena and Śrutasena.[6] According to the Vedic text, *Aitareya Brāhmaṇa*, Tura Kāvaṣeya consecrated Janamejaya and was his purohita.[7] The same information is furnished by the *Bhāgavata Purāṇa*, which mentions that Tura Kāvaṣeya was a priest of Parīkṣit's son, Janamejaya.[8] The interesting part of the traditional account of Parīkṣit is the mention of two kings bearing the same name, Parīkṣit. It has been noticed that there is no unanimity regarding the parentage of one of the two Parīkṣits. He figures variously as the son of Avīkṣita, Anāśva or Kuru and is also mentioned as an ancestor of Pratiśravas and Pratīpa.[9] The other one is stated to have been a descendant of Pratīpa and has been unanimously called a son of Abhimanyu.

The question has been raised, and it can still be raised, as to which of the two Parīkṣits, of the epic or the Purāṇic account, is identifiable with the Parīkṣit of the Vedic account. An attempt has been made to identify Parīkṣit I of the epic and Purāṇic accounts with the Vedic Parīkṣit.[10] Both Vedic and Purāṇic evidence can be cited in support of this hypothesis. Thus, in the *Śatapatha Brāhmaṇa*[11] and *Śāṅkhāyana Śrauta Sūtra*,[12] Indrota Daivāpa Śaunaka is mentioned as a priest of Janamejaya, son of the Vedic Parīkṣit. In no less than five Purāṇas, namely the *Vāyu*,[13] *Brahmāṇḍa*,[14] *Harivaṁśa*,[15] *Brahma*[16] and *Liṅga*,[17] Indrota Daivāpa Śaunaka figures as chaplain to the son of Parīkṣit I. There is yet another point of similarity between Parīkṣit I of the Purāṇic account and Vedic Parīkṣit. Thus the *Śatapatha Brāhmaṇa*,[18] and the *Śāṅkhāyana Śrauta Sūtra*[19] relate that Parīkṣit had four sons, namely, Janamejaya, Śrutasena, Ugrasena and Bhīmasena. The same detail is available in the *Viṣṇu Purāṇa*,[20] which also adds that the eldest son had a quarrel with the Brāhmaṇas.

In the context of the problem of the identification of Parīkṣit, some other facts have to be taken into account before arriving at any conclusion, either tentative or final. Scholars like

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Roth, Bloomfield, Zimmer and Oldenberg have located a very pertinent passage in the *Atharvaveda*,[21] where Parīkṣit appears with a number of laudatory expressions, high-sounding epithets and honorifies. He is called a king who rules over all peoples (*rājano viśvajanīnasya*), a god who is above mortals (*yo devo mṛtyamati*), a king of the Kurus (*Kauravya*) whose kingdom flowed with milk and honey, where people thrived merrily (*janaḥ sa bhadramedhanti*). Opinions differ regarding the Pārīkṣita of this description. Roth and Bloomfield regard him as a divine being. On the other hand, Zimmer and Oldenberg recognize him as a human king. The latter hypothesis is supported by the evidence of the *Satapatha Brāhmaṇa* and *Aitareya Brāhmaṇa*.[22] In both these texts, Janamejaya bears the patronymic Parīkṣit, i.e., son of Parīkṣit. The designation *Kauravya* of the above-mentioned account is of special significance. As Raychaudhuri observes, during the days of Parīkṣit mentioned in the account, the designation under reference had ceased to be a mere royal patronymic and was applied to ordinary citizens in Kuru land.[23] It has been emphasized that Kuru had become the eponymous ancestor of the entire race. These are some of the distinguishing particulars which, according to Raychaudhuri, can hardly be applied to the 'Shadowy Parīkṣit I' of the epic and Purāṇic lists, who is said to be very near in time to Kuru himself. In this context, Raychaudhuri refers to the passages of the *Vāyu Purāṇa*[24] and the *Harivaṁśa*,[25] where Parīkṣit seems to be identified with Kuru himself and his son (Parīkṣit) is called *kuroḥ pūtraḥ*, i.e., son of Kuru.

In its Chapters XVI, XVII and XVIII, the *Bhāgavata Purāṇa* depicts the famous *ākhyāna* of Abhimanyu's son Parīkṣit, who is eventually Parīkṣit II. It is narrated that the said king had undertaken a *digvijaya*. He had been successful in subjugating all the sub-continent (*Varṣāṇi*). He is also styled a god among men, who is much above the ordinary man (*na vai nṛbhirnaradevam parākhyam sammātumarhasi*). It is added that, under his protection, people thrived and had nothing to fear (*vindanti bhadrāṇyakutobhayāḥ prajāḥ*). Raychaudhuri makes pointed reference to the 'content and phraseology' of the present *ākhyāna* and notes its similarity with the laudatory account of the *Atharvaveda* noted above. This, according to him, is proof of the *identity of this Parīkṣit* (son of Abhimanyu) with his Vedic namesake.

The question as to whether a Janamejaya Parīkṣit before the Pāṇḍavas should be regarded as a real person and not a 'shadowy' figure has been taken into account by A.D. Pusalker.[26] The noted scholar points out that the Purāṇas and the *Mahābhārata* refer to two Janamejaya Parīkṣits, one an ancestor of the Pāṇḍavas (being grandson of Kuru) and the second a successor of the Pāṇḍavas (grandson of Arjuna). He cites the evidence of the *Aitareya Brāhmaṇa*[27] and *Śatapatha Brāhmaṇa*,[28] alluding to the performance of Aśvamedha sacrifice by Janamejaya. The present *ākhyāna* is available in *Mahābhārata* also,[29] where Bhīṣma narrates the story of Janamejaya's Aśvameda to Yudhiṣṭhira. It is said to be an ancient legend. This has been taken as proof that the Aśvamedha referred to was performed by an ancestor of the Pāṇḍavas, and that a Janamejaya Parīkṣit of the pre-Pāṇḍava times was a real person. On the basis of the same passages of the *Harivaṁśa*,[30] Pusalker points out that the latter Janamejaya is known to have performed Sarpasatra and not Aśvamedha. Mention has been made of a passage of the *Śatapatha Brāhmaṇa* which refers to another sacrifice performed by Janamejaya Parīkṣit under the priestly supervision of Indrota Daivāpa Śaunaka in order to expiate a heinous crime relating to the killing of a Brāhmaṇa.[31] On the other hand, there is no reference, either in the Purāṇas or in the *Mahābhārata*, associating Janamejaya, the descendant of the Pāṇḍavas, with any guilt. Thus the allusion is to the early Janamejaya and not to the one who flourished later. Evidence to this effect is also supplied by a narrative in the *Mahābhārata* in which the son of Janamejaya is told by Bhīṣma about Janamejaya inadvertently killing a Brāhmaṇa.[32] In support of his hypothesis, Pusalker cites a passage from the *Harivaṁśa*,[33] which indicates that the Aśvamedha story relates to the earlier Janamejaya. The interesting part of the present story is that Janamejaya, eventually a descendant of the

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Pāṇḍavas, is its audience, while Vaiśampāyana is the narrator. Reference is made in the narrative to the fact that there were two Janamejaya Parīkṣits in the Paurava lineage.

Before closing our note on one of the knotty problems of traditional history, we may specify that, in all probability, the original form of the Janamejaya Parīkṣit tradition has not been faithfully preserved in the texts examined by scholars so far. It is not unlikely, as Raychaudhuri would like to put it, that Parīkṣit I and Parīkṣit II represent a bardic duplication of the same original individual.[34] Abundant examples of such duplication are available in the traditional accounts. The genealogical lists quoted by Keith and Macdonnell[35] Söresena[36] and Pargiter,[37] show that there were a hundred Prativindhyas, Nāgas, Haihayas, Dhṛtarāṣṭras, Brahmadattas, Paulas, Śvetas, Kāśis and Kuśas, eighty Janamejayas, a hundred Śaśabindus and two hundred Bhīṣmas and Bhīmas.[38] In the main Paurava lineage there are stated to have been two Ṛksas, two Parīkṣits, three Bhīmasenas and two Janamejayas.[39]

NOTES

1. H.C. Raychaudhuri, *Political History of Ancient India*, p.11.
2. *Matsya Purāṇa*, 50.57.
3. *Mahābhārata*, 1, 3.1
4. *Ancient Indian Historical Tradition*, p. 113, n.9.
5. *Yo'Yam sāmpratamavanīpatiḥ tasyāpi janamejayaśrutasenograsenabhīmasenaḥ putrāścatvāra bhaviṣyanti*
   —*Viṣṇu Purāṇa*, IV, 21.1
6. *Vedic Index*, I, p. 520.
7. *Aitareya Brāhmaṇa*, VII.5, 34; VIII, 4, 21.
8. *kāvaṣeyam purodhāya turam turugamedharāt/*
   samrat pṛthvim sarvām yakṣyati cādhvaraiḥ//—Bhāgavata Purāṇa, IX, 22, 25-7.
9. Thus regarding Parīkṣit I, *Matsya Purāṇa*, 50, 23; says,
   kurostu dayitāḥ putrāḥ sudhanvā jahnureva ca/
   parīkṣicca mahātejāḥ pravaraścārimardamaḥ//
10. *Vedic Index*, I, p.78.
11. *Śatapatha Brāhmaṇa*, XIII, 5.4.1.
12. *Śāṅkhāyana Śrauta Sūtra*, XVI, 9, 7.
13. *Vāyu Purāṇa*, 93, 21-6.
14. *Brahmāṇḍa Purāṇa*, III, 68, 20-6.
15. *Harivaṁśa*, 30, 1608-13.
16. *Brahma Purāṇa*, 12, 9-15.
17. *Liṅga Purāṇa*, 1, 66, 71-7.
18. *Śatapatha Brāhmaṇa*, XIII, 5.4.1.
19. *Śāṅkhāyana Śrauta Sūtra*, XVI, 9, 7.
20. *Viṣṇu Purāṇa*, IV.20 and V.21.
21. *Atharvaveda*, XX, 127, 7-10.
22. *Aitareya Brāhmaṇa*, VIII, 21.
23. Raychaudhuri, op. cit., p.13.
24. *Vāyu Purāṇa*, 93, 21.
25. *Harivaṁśa*, XXX, 9.
26. *Vedic Age*, pp. 313-14.
27. *Aitareya Brāhmaṇa*, VII, 27; VIII, 21.
28. *Śatapatha Brāhmaṇa*, XIII, 5,4, 1-4.
29. *Mahābhārata*, VII, 150, 2.
30. *Harivaṁśa*, III, 2, 5-6; 28-9; 5.11-17.
31. *Śatapatha Brāhmaṇa*, XIII, 5,4,1ff.
32. *Mahābhārata*, XII, 150.3.
33. *Harivaṁśa*, 1, 32, 100-1.
34. Raychaudhuri, op. cit., p. 16.
35. Macdonnell and Keith, *Vedic Index*.

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36. *Index to Mahābhārata.*
37. *Ancient Indian Historical Tradition.*
38. *Brahmāṇḍa Purāṇa*, III, 74, 267-9; *Vāyu Purāṇa*, 32, 49-52; 99, 453-8; *Mahābhārata*, II, 8. 333-6; *Matsya Purāṇa*, 273. 71-3.
39. *Brahma Purāṇa*, 13, 112-13; *Harivaṁśa*, 32.1817-18.

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APPENDIX B

A Note on the Chronological Implications of the Genealogical Lists of the Purāṇas

Following Altekar, we have discussed above some cases where the Vedic literature confirms the Purāṇic evidence on the genealogy of the pre-Bhārata-war period. We shall not be erring on the side of caution in stating that the pre-Bhārata-war genealogies of the Purāṇas are basically related to the contemporary and early history preserved in the Vedic literature. The fact can hardly be denied that while the Vedic literature preserves ritualistic, religious and philosophical practices and beliefs of the age, it is not altogether silent about political history. It has rightly been observed that a close study of the Vedic literature shows that, 'it confirms to a surprising degree the information to be gathered from the scanty Paurāṇic accounts of the pre-Bhārata war dynasties on several important points.[1] In this connection, attention may be drawn to the importance of the fixation of the date of the Bhārata war. As a matter of fact, the entire history from Manu Vaivasvata to the end of the Barhadratha dynasty hinges on the fixation of the date of the Bhārata war.[2] However, scholars have never been unanimous regarding the date of this great event. Various arguments have been put forward in this controversy, setting dates ranging right from the third-fourth millennium BC, to about the first millennium BC. Thus wide divergencies of opinion still exist concerning this event of phenomenal importance.[3] However, the date of *circa* 1400 BC has gained widespread acceptance and has proved to be of much help in determining the chronological position of the pre-Bhārata-war genealogy preserved in the Purāṇa tradition. Although we cannot fix the reign period of any of the pre-Bhārat-war rulers, the chronology of a particular king or event as so many generations before the Bhārata war can be determined to some extent. Besides, we can also fix a probable average for one reign. It may be, thus, possible to fix the date of each one of the events and kings of the Purāṇa account mentioned above, 'as being so many generations and therefore years before Bhārat war, i.e., before 1400 BC'. Since the Purāṇas do not supply information about the reign periods of any of the pre-Bhārata-war rulers, as they do in the case of almost every king of the post-Śiśunāga period, a better, alternative, method is hard to find.

It is in this light that we now consider some cases, most of which have already been examined by a number of scholars from different angles. Considering the limited scope of the present note, it would not be possible to reproduce or reformulate their hypotheses in a broader perspective. However, it would be worthwhile to point out, as Altekar shows, that 'some of the synchronisms established by the Purāṇic data get surprising confirmation from the Vedic evidence also.'[4] Thus, a passage of the *Aitareya Brāhmaṇa* (VII.34) refers to Somaka, son of Sahadeva; Sahadeva, son of Śrīñjaya; Babhru, son of Devavṛdha; and Bhīma and Nagnajit of Vidarbha and Gandhāra countries respectively. The passage also makes it evident that these rulers were contemporaries. This conclusion is also brought out by the Purāṇa account. It includes Kings Śrṇñjaya and Sahadeva in the North Pañcāla genealogy. Like in the

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Aitareya Brāhmaṇa, in the Purāṇa account also Somaka is mentioned as son of Sahadeva. But Śrīñjaya is said to be the grandfather of Sahadeva. As shown above in the passage from the *Aitareya Brāhmaṇa*, Śrīñjaya figures as father of Sahadeva. This may be a case of oversight on the part of the copyist. In respect of Babhru, it has been established that he belonged to a junior Yādava branch. He was a grandson of Sātvata of the main line through his second son, Devavṛdha.[5] It has been shown that Sātvata was a contemporary of Śrīñjaya. Thus, the contemporaneity evidenced by the *Aitareya Brāhmaṇa* is also revealed by the Purāṇa account. Bhīma of Vidarbha was also a contemporary of these rulers, as Pargiter's tables would lead us to believe. Nagnajit of Gandhāra, however, does not figure in the Purāṇic lists. His contemporaneity cannot be ascertained. The methodology adopted by Altekar thus shows that at least four out of the five kings seeming to be contemporaries in the Vedic account figure as contemporaries in the Purāṇic account also. Regarding, the reliability of the Purāṇic lists of genealogy, it has been shown that these kings flourished for about 30 generations, i.e., 450 years, before the Bhārata war. Evidently, the average reign period in the case of the pre-Bhārata war rulers is taken as 15 years, and the date of the war as *c.* 1400 BC. It is thus reasonable to place these rulers somewhere in the nineteenth century BC. An attempt has also been made to fix the date of the *dāsarājña* battle in the light of the genealogical account of the Purāṇa tradition. Thus King Śrīñjaya is said to have been four generations junior to King Śudāsa, the well-known hero of the Dāsarājña war. In view of this, it has been shown that this famous war took place about 60 years earlier. Accordingly, *c.* 1900 BC has been tentatively fixed as the date of that event.[6]

There is no doubt that the aforementioned methodology can help us most comfortably to determine the time of various other rulers of the genealogical account of the Purāṇas mentioned above, in the main paper. But this can be done only in prolonged discussion of various issues, such as correlation and comparison of the Vedic and Purāṇic traditions and bearing the proposed date of the Bhārata war etc. in mind, discussion of which cannot be accommodated in the present note.[7]

Notes

1. *Proceedings of the Indian History Congress*, III, p.53. S.B. Choudhury has tried to show that the original traditions of all Purāṇic stories were current contemporaneously with the Vedic legends. ('Antiquity of Purāṇic Story Traditions', *Journal of Indian History*, III, pp. 1-17.) While answering the question, 'Purāṇic Traditions—Is it Vedic?' V.C. Bhattacharya states that the set of traditions propagated by the Purāṇas is basically founded on the Vedic heritage. (*Journal of the Ganganatha Jha Research Institute*, XV, pp. 109-33). In the present context, Pargiter's well-known work, *Ancient Indian Historical Tradition*, is of special note. It reconstructs ancient Indian history from the beginning of Purāṇic accounts, which start with pre-Flood dynasties beginning with Svayambhuva Manu and goes on to the Bhārata War. Pargiter has established a number of synchronisms and has presented his results in tabular form, facilitating easy reference.
2. A.D. Pusalkar has divided the history of ancient India from the time of Manu Vaivasvata onwards into five main periods: the Yayāti period (*c.* 3000-2750 BC), the Māndhātri period (*c.* 2750-2550 BC), the Paraśurāma period (*c.* 2550-2350 BC), the Rāmacandra period (*c.* 2350-1950 BC) and the Kṛṣṇa period (*c.* 1950-1450 BC). (*The History and Culture of the Indian People*, vol. 1, p. 267ff.) Can we concede that, within reasonable probabilities, phases as suggested by Pusalkar appear to be convincing?
3. See *Journal of the Ganganatha Jha Research Institute*, vol. IV, 1946-47, pp. 35-44; 229-33; vol. VIII, 1950-51, pp. 1-60; 203-13; *Journal of Indian History*, vol. XXVI, pp. 1-20.
4. Altekar, op. cit. (under ref. 5 to the main body of the chapter), p. 54.
5. Surprisingly enough, King Babhru, son of Devavṛdha, does not figure in Pargiter's table.
6. Altekar, op. cit., p. 55. Besides, he gives dates for Gṛtsamada (2700 BC), Atri (2600 BC), Citraratha (2000 BC), Viśvāmitra (2300 BC) etc., and assigns the hymnal activity of the Vedic period at 2700-1500 BC; the Brāhmaṇa period at 1600-1000 BC, and the Upaniṣads at 1200-600 BC.
7. So far, the point has not been elaborated by any scholar, not even by Altekar, on whose studies the present note is essentially based.

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SECTION II

GEOGRAPHY AND ETHNOGRAPHY

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CHAPTER III

Physical Features of India

Indra Pal

INTRODUCTION

A history of Indian science, philosophy and culture must take into account developments over the whole Indian subcontinent, which means the whole of the pre-1947 India or Bhāratavarṣa.

The primary sources of the ancient geography of India are the Purāṇas in which is compiled information from the Vedas and the epics, the *Rāmāyaṇa* and *Mahābhārata*. The *Bhāgavata Purāṇa* gives details of world geography, particularly that of Bhārata. Later on, the information was collected from the accounts of pilgrims and the diaries of foreign travellers in India. However, current geographic information is obtained from the ground and aerial surveys, as well as by the study of satellite imageries obtained through remote-sensing techniques.

India is a land of lofty mountains, majestic snow-clad peaks, vast ice-fields and mighty rivers with deep gorges, roaring waterfalls over high precipices and one of the most extensive and fertile plains of the world. No other country in the world is richer in its variety of scenic beauty and grandeur and panoramas of contrasting landscapes at different stages of evolution. Few other countries surpass it in the extent of arable land.

INDIAN STRATIGRAPHY: GEOLOGICAL FORMATION

More than half of the Indian Peninsula consists of gneissic and schistose rocks of the Archaean and Proterozoic Ages. Cuddapahs, Vindhyans, Gondwana and Deccan Trap occupy the rest of the area, except parts of the coastal regions. In the Extra-Peninsula, marine sedimentary systems predominate, though parts of the sub-Himalaya and the main axis of the Himalaya consist of ancient metamorphic rocks and intrusive igneous rocks. A full system of fossiliferous sedimentary systems extending from Cambrian to Eocene is met with on the Tibetan side of the Himalaya, while the southern or sub-Himalayan zone contains a different facies which is practically unfossiliferous. The fossiliferous facies transgresses to the south of the central Himalayan zone in Kashmir.

Beyond the sharp syntaxial bend of the northwestern Himalaya near Nanga Parbat, the Hazara area shows unfossiliferous Palaeozoic and later fossiliferous formations; but further south, the Baluchistan arc is built up mainly of post-Carboniferous systems which sweep down in a broad arc to the Makran region. The eastern part of this, forming the mountain chains

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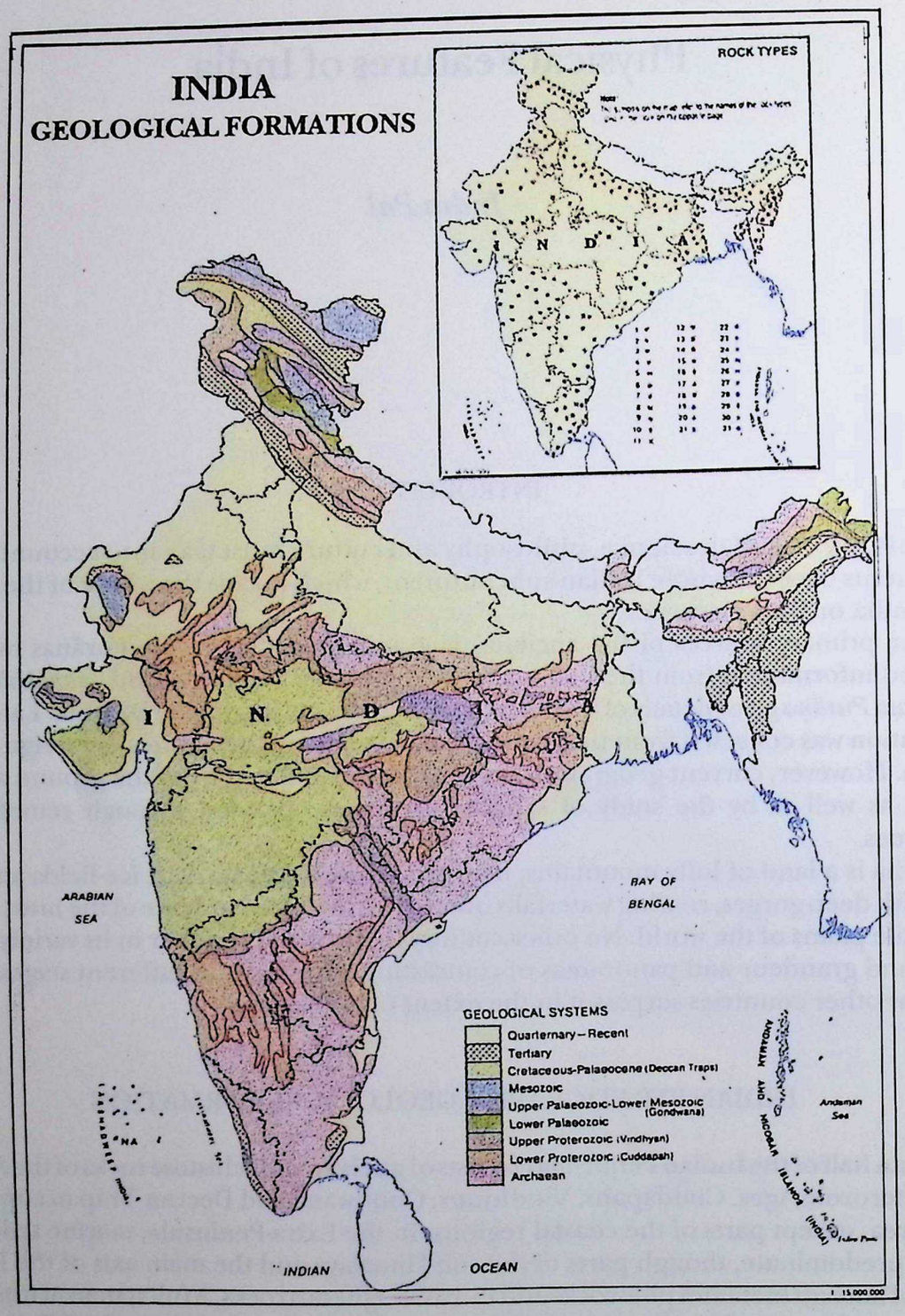

Fig. 1: *Geological Formations; Rock Types* (Numbers correspond to numbers of symbols used in inset 'Rock Types' map). **Igneous—intrusives**: 1. *Granite, Grano-diorite, Pegmite*; **Igneous—Effusive**: 2. *Basalt, associated lavas and tuffs*; 3. *Rhyolite*; **Sedimentary—Unconsolidated**: 4. *Recent Alluvium*; 5. *Older alluvium*; 6. *Blown sand;* 7. *Laterite;* 8. *Sandstone*; 9. *Sandstone, Shale*; 10. *Sandstone, Shale, Limestone*; 11. *Sandstone, Shale, Conglomerate*; 12. *Sandstone, Quartzite*; 13. *Shale*; 14. *Shale, Sandstone*; 15. *Conglomerate, Clay*; 16. *Limestone*; 17. *Limestone, Shale*; 18. *Limestone, Slate*; **Metamorphic**: 19. *Quartzite*; 20. *Quartzite, Limestone*; 21. *Quartzite, Shale*; 22. *Quartzite, Schists*; 23. *Quartzite, Phyllite*; 24. *Slate, Quartzite*; 25. *Slate, Quartzite, Schists*; 26. *Schists*; 27. *Schists, Phyllite, Slate, Quartzite*; 28. *Schists, Gneisses, Quartzite*; **Other Igneous and Metamorphic**: 29. *Khondalite*; 30. *Charnockite*; **Unclassified Crystalline**: 31. *Gneisses*

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of Sulaiman-Kirthar-Laki, shows a calcareous facies while the western part is largely a shale facies with flysch-like lower Territories. To the east and south of the syntaxies of northeastern Assam, in the Burmese arc, Tertiary rocks form a broad zone with a core of Mesozoic rocks which constitute the mountains of the Assam-Burma border and the Arakan Yomas to their east is the Shan-Tenasserim belt of pre-Tertiary rocks which belong to the southeast Asian geological province.

The major stratigraphical division of India are shown in Table 1 together with their European equivalents, these being arranged in the order of increasing antiquity.

TABLE 1

MAJOR GEOLOGICAL FORMATIONS OF INDIA

Recent	Recent alluvia, sand-dunes, soils.
Pleistocene	Older alluvia, karewas of Kashmir, and Pleistocene river terraces, etc.
Mio-Pliocene	Shivalik, Irrawaddy, and Manchhar systems; Cadalore, Warkilli and Rajmahendri sandstones
Oligo-Miocene	Murree and Pegu systems, Nari and Gaj series
Eocene	Ranikot-Laki-Kirthar-Chharat series;
Cretaceous	Deccan traps and inter-trappeans
Cretaceous	Cretaceous of Trichinopoly, Assam and Narmada Valley; Giumal and Chikkim series, Umia beds
Jurassic	Kioto limestone, and Spiti shales; Kota-Rajmahal and Jabalpur series
Triassic	Lilang system including Kioto limestone; Mahadeva and Panchet series
Permian	Kuling system; Damuda system
Carboniferous	Lipak and Po series; Talchir series
Devonian	Muth quartzite
Silurian	Silurian of Burma and Himalayas
Cambrian	Haimant system; Garbyang series
Pre-Cambrian	Cuddapah and Vindhyan systems; Dogra and Shimla states; Martoli series
Archaean	Dharwar and Aravali systems, Salkhala, Jutogh and Daling series, various gneisses, etc.

In 1904, in an article in the *Imperial Gazette of India*, Sir T.H. Holland proposed a new classification of Indian strata in which the Cuddapah and Vindhyan systems were grouped together under the name, Purāṇa Group, corresponding to the Algonkian of America, which is now referred to as the Proterozoic. The strata from the base of the Cambrian to Middle Carboniferous were put together under the Dravidian Group. At the top of this group and below the Talchir boulder-beds there is a well-marked and universal unconformity. All the rocks from the Talchi boulder-beds upwards were placed under the Aryan Group which therefore includes everything from the Upper Carboniferous to the Pleistocene. Of these, only the term 'Purāṇa' is sometimes used in Indian geological writings; the other two terms have not gained any currency.

There are several stratigraphical problems in this subcontinent which await solution. By far the greater part of India has been mapped in a general way but there are still some blanks in the Assam-Burma border area and in the Himalaya. A generalized picture of the geological succession in different areas is presented in Table 2.

THE GEO-SYNCLINE: THE GENESIS OF THE FOLD MOUNTAIN SYSTEM

The formation and filling of a geo-syncline are the necessary prelude to the formation of a folded mountain range on the same site. An ancillary condition is the existence of bordering

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TABLE 2

GENERAL GEOLOGICAL SUCCESSION IN DIFFERENT PARTS OF THE INDIAN SUBCONTINENT

(Sy. = System; S. = Series; B. = Beds; Sst. = Sandstone; Lst. = Limestone)

Standard Scale	*Northern Himalaya*	*Baluchistan Arc*	*Salt Range & Potwar*	*Kashmir-Hazara*	*Simla-Garhwal*	*Assam*	*Peninsula*	*Coastal Areas*
Recent	Alluvum	Sands, Loess	Alluvium Loess	Alluvium etc.	Alluvium etc.	Alluvium River gravel	Alluvium Khadar	Alluvium sands
Pleistocene	Older alluvium gravels moraines	Older alluvium sands	Older alluvium etc.	Older alluvium moraines Upper Karewa	Older alluvium moraines	Older alluvium gravels	Older alluvium Bangar, cave deposits, river terraces	Raised beaches Porbander stone etc.
Pliocene Upper Miocene	—	Shivalik Sy. Manchhar Sy.	Shivalik Sy.	Lower Karewa Shivalik Sy.	Shivalik Sy.	Dihing S.	—	Shivalik Sy. Karaikal B., Quilon B., Cuddalore Sst. etc
Middle Miocene Lower Miocene	—	Mekran Sy. Flysch, Bugti B., Gaj S.	Muree S.	Muree S., Fatehjang Zone	Kasauli B., Dagshai B.	Tipam S. Sarma S.	—	Gaj S.
Oligocene	—	Nari S., jal shales	—	—	—	Barail S. (in part)	—	Nari S. Dwarka B.
Eocene	Eocene	Kirthar S. Laki S. Ranikot S.	Chharat S. Kirthar S. Laki S. Ranikot S.	Chharat S. Hill Lst. Ranikot S.	Subathu B.	Barail S. Jaintia S. Sylhet Lst. Disang S. Cherra Sst.	Deccan Trap and Intertrappe-ans, Lametas	Kirthar S. Laki S. Ranikot S.
Up. Cretaceous	Up. Cretaceous Chikkim S.	Cardita Beaumonti B. Pab. Sst.	Up. Cretaceous	Up. Cretaceous	—	Disang S. (in part) Up. Cretaceous	—	Bagh B. Trichinopoly Cretaceous

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Standard Scale	*Northern Himalaya*	*Baluchistan Arc*	*Salt Range & Potwar*	*Kashmir-Hazara*	*Simla-Garhwal*	*Assam*	*Peninsula*	*Coastal areas*
L. Cretaceous	Giumal Sst.	Parh Lst.	L. Cretaceous	Giumal S. Orbitolina Lst.	—	—	Umia B.	Umia B.
Jurassic	Spiti shales Kioto Lst.	Massive Lst. Crinoidal Lst.	Jurassic	Spiti shale Jurassic	? Tal S.	—	Jubbulpore Kota Rajmahal	Katrol Chari Patcham
Triassic	Triassic	Triassic	Triassic	Triassic	? Shali Lst. ? Krol S.	—	Maleri Pachmarhi Panchet	—
Permian	Products B. Syringothyris Lst.	Permo-Carboniferous	Productus Lst. Speckled Sst.	Agglomeratic Slates, Zewan B.	! Infra-krol	—	Raniganj S. Barren Measures, Barakar S.	—
	—	—	Conularia and Eurydesma B.,	Agglomeratic-fish. Gangamopteris B.,	—	—	Umaria B.	—
Up. Carboniferous	—	—	Boulder bed	Tannakki Boulder B.	? Blaini boulder bed	Subansiri B.	Talchir boulder B.	
Middle & L. Carboniferous	Po series Fenestellash	—	—	Fenestellash	—	—	—	—
Devonian	Muth Qtzt.	—	—	Muth Qtzt. Devonian (Chitral)	? Jaunsa S.	—	—	—
Silurian	Silurian	—	—	Silurian	—	—	—	—
Ordovician	Ordovician	—	—	Ordovician	—	—	—	—
Cambrian	Cambrian	—	Canbrian	Canbrian	? Deoban Lst.	—	Vindhyan Sy.	—
Upper Pre-Cambrian	Haimanta	—	Attock Slates	Dogra Slates	Simla Slates	Buxa S. Daling S. Darjeeling S.	Cuddaph Sy. Delhi Sy.	—
L. Pre-Cambrian and Archaean	Vaikrita Sy.	—	?	Salkhala S. Gneisses	Chail S. Jotogh S.	Shillong S. Gneisses	Dharwar Sy. Aravali Sy. etc. Gneisses	—

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land masses to supply the sedimentary filling into the geo-syncline between the land masses. Peninsular India is understood to be a part of a major land mass of the oldest shield area of the world, Gondwanaland, having a complex gneissic and granitic foundation represented by Gondwanaland, while the Angaraland (Central Asia) formed another land mass separated from the first by a long, narrow belt—a geo-syncline, the so-called Tethys Sea. These stable ancient land masses of great rigidity are responsible for the genesis of all the old, as well as the young fold mountains of the Indian subcontinent. However, the recent earthquake in southern Maharashtra has, surprisingly, raised doubts about the stability of the southern land mass.

MOUNTAINS AND PLATEAUS OF INDIA

The *Matsya Purāṇa* describes in detail the *mountains and rivers of Bhāratavarṣa.* For convenience of description of its physical features, the subcontinent is divided into two parts, the *Peninsular region* and the *Extra-Peninsular region.*

The Peninsular Region

The Peninsular Region, occupying nearly seventy percent of the land area, consists of a great tabular block (the most ancient *Indian shield*), including the Shillong Plateau in the north-east (buried under Ganga alluvium) and the Kutch-Kathiawar region in the west. This block also extends to the west of the Aravali in Rajasthan and beneath the Punjab alluvium, as evidenced by the Kiran Outcrop.

Most of the Peninsula is covered by pre-Cambrian rocks. The mountain ranges in the region are remnants of hard, deeply eroded parts of very old folded mountains that were formed around the margins of the still older nucleus or heartland of the Peninsula. All Upper Palaeozoic or younger rocks are horizontal or gently dipping, as most of the disturbances that have affected the area since the Upper Palaeozoic were rectilinear. The faults thus created have been responsible for the preservation of the coal deposits of India.

The Deccan Lavas or Deccan Traps: The Deccan Lavas (styled *Deccan Traps* in the earlier literature) are generally 610-1525m thick and reach a maximum of 3,500m. They cover some 518,000 sq km of area with their measa-like terrain. These practically horizontal and, in the main, remarkably homogeneous basalts were probably erupted from fissures towards the end of the Cretaceous. The true Deccan lies within the frame formed by the Satpura-Maikal-Hazaribagh hills, the Western Ghats, the Eastern Hills and the Cuddapah ranges. The lavas were poured onto a land surface which had already attained an advanced stage of maturity, and form a most striking feature in the geomorphology of the Peninsula, with an obvious family likeness to the basaltic flows of the Colombian Plateau and of the southern Brazilian Plateau.

The Fault Mountains of Peninsular India: The Western Ghats and Eastern Ghats are faulted ranges which have been exposed to atmospheric weathering for hundreds of millions of years and been eroded to base level of erosion several times over, but again lifted each time to their present position due to differential earth movements. The gorges and waterfalls of these Ghats owe their origin to the rejuvenation of the rivers by later uplifts of the regions concerned.

The Western Ghats Fault Range: The western part of this peninsular region might have faulted and subsided to the Arabian Sea floor while the remaining eastern part forms the present Western Ghat (also called the Sahyadri Fault Mountains) that ramparts the entire western rim of Peninsular India from the Satpura to the Nilgiri. During this episode, the peninsular block tilted to the east and so all the rivers of Peninsular India drain eastwards.

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They are fed by a large quantity of rainfall from the South-West monsoon which make falls on the terraced slopes and present numerous sites for constructing big reservoirs and developing hydroelectricity and irrigation.

The Western Ghat may be divided into northern, central and southern Sahyadri. The Northern Sahyadri runs for 640 km and is built of a horizontal sheet of lava, the Deccan Trap. Thalghat and Bhorghat are the important passes through which roads and railways run between the Deccan Plateau and the Konkan Plain. For the next 640 km, from 16° N latitude southwards to the Nilgiri runs the Central Sahyadri. It has a rugged terrain and dense vegetation, adverse to human habitation. The Palghat Gap, trending east-west, marks a prominent break in the continuity of the Ghat. It is about 24 km wide at its narrowest point and lies at an elevation of 144 m, whereas the bordering ranges rise from 1,500 to 2,000 m.

The South Sahyadri again continues southwards. It bears different names in different parts. Anai Mudi, the highest peak (2,695 m) is a nodal point from which three ranges radiate in three different directions: the Anaimalai in the north, the Palni in the north-east, and the Cardamom Hills in the south.

The Eastern Ghat Fault Range: Like the Western Ghats, the Eastern Ghat (its ancient name is Mahendragiri) bordering the Peninsula on the east is also a tectonic range but does not now run continuously along the entire coastline of eastern India. Once continuous from north to south, they have, over the ages, been widely cut by powerful river erosion creating wide gaps between a series of highlands. Their true mountain character is exhibited only between the Mahanadi and Godavari rivers (75,000 sq km). They almost disappear between the Godavari and the Krishna. Except in the wild forested country of Orissa and Bastar these detached hills seldom exceed 100 m in height.

The southern section of the Eastern Ghat also occurs mostly as detached low hills, developing range character only in Cuddapah and Kurnool districts of Andhra Pradesh, North of the Cauvery (Kavery) the Malayagiri range is noted for sandalwood and other valuable timber.

The Fold Mountains of Peninsular India: The Aravali, Vindhya and Satpura ranges, with other minor ranges, form a compact block of fold mountains surrounding a number of plateaus, which separate Peninsular from Extra-Peninsular India. Covering about one-sixth of the total area of India, much of this mountainous terrain is forested and is the homeland of aboriginal tribes.

Like the Tethys Sea at the site of the Himalayas, there might have been an ancient geo-synclins at the site of the Aravali, sedimented from the peninsular region, out of which the *Aravali range* uplifted during the Algonkian age, 600 to 700 million years ago. In that remote age, several of its summits rose above the snow-line but have since been peneplaned and again uplifted in the Cambrian and again before the permo-Carboniferous glaciation. The Aravali may perhaps claim to be the oldest mountain system on the earth's surface, still recognizable as such by its relief and the absence of fossils.

The Aravali now extends from Ahmedabad to Delhi, diagonally across Rajasthan. It sinks to low hills in the Jodhpur-Jaipur saddle and rises again before petering out in little echelonned ridges, half buried in Indo-Ganga alluvium, and reaching as far as the Delhi Ridge. The gaps in the Aravali are used for all kinds of traffic and also by sandstorms from the western plains.

South of Beawar, the Aravali becomes a tightly compressed synclinal range. Beyond this point it divides into a number of parallel folds between which are enclosed several plateaus of which the Bhorat plateau, between Kumbhalgarh and Gogundia, with an average elevation of 900 m, is the highest. Guru Sikhar (1722 m) on the granitic Abu hills is the highest peak of the Aravali. Mt Abu (1,158 m) is the only hill-station in Rajasthan. The flat-topped granite

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hills in the Aravali have provided excellent sites for constructing the numerous strategic forts scattered all over Rajasthan.

In each cycle, the products of the weathering of the ancient Aravali range were ultimately deposited in the Vindhyan Sea (another geo-syncline), to form later the east-west running *Vindhyan* range as the dividing line between north India and the Deccan. The Malwa and Vindhyan plateaus so formed tilted to the north and drain the Chambal, Betwa and Ken rivers northwards.

Finally, in Kutch and Kathiawar, and along the southern coast, patches of marine, Jurassic, Cretaceous and Tertiary rock bear witness to marginal transgression by the sea. Ongoing oil searches may reveal seaward extensions of the land.

The name Vindhya occurs expressly in the *Vaśiṣṭha Dharma Sūtra* and the *Manusmṛti*. The Vindhyan-Kaimur scarp, the most pronounced scarp of India, starting from Dhar District of Madhya Pradesh, runs eastwards in a curve. Remarkably regular and free from gaps, its convex side faces the Narmada Valley and follows a 300 m contour line, exceeding 610 m only in the Kaimur range. In the western part it passes through basaltic rocks and from Hoshangabad onwards through sandstones alternating with shales.

Like the Vindhyan range the *Satpura* range (meaning seven parallel ranges) is another east-west trending range. Its western most part is formed of basalt which overhangs the Narmada Valley. The central part is bordered by the Mahadeva range and the eastern part is known as the Maikal range. The latter runs from Raj Nandgaon in north-eastern direction to the Amarkantak knot. This knot is a mixed lava and genissic upland, radiating the headwaters of the rivers Narmada, Son, Mahanadi and Wainganga. Its highest peak (1,350 m) is near Pachmarhi hill-station. Its total mountainous area is 7,500 sq km.

The Extra-Peninsular Region

Fold Mountain Ranges—The Himalaya: In contrast to the Peninsular region, the extra-Peninsular region is a weak and flexible portion of the earth's crust which has been folded, faulted and over-thrust. The steepness and depth of Himalayan gorges are indicative of the recent uplifts. The longitudinal portion of the gorges was determined when the Himalayan region first rose from the Tethys Sea (Trans-Himalaya) and the down-cutting of the gorges kept pace with the upheaval and folding of the range. In addition to an ancient substratum of rocks (similar to the oldest peninsular rocks) which were deposited in a major pre-Cambrian geo-syncline and compressed to form the earliest Himalayan ranges, there are immense thicknesses of marine strata, representative of all systems from Cambrian to Tertiary. The Great Indo-Gaṅgā Plain forms part of extra-peninsular India.

The Great Himalaya and the Lesser Himalaya: During Mesozoic times the Tethys Sea was filled with material eroded from the bordering stable land masses, the Asian tectonic plate, Angaraland, to the north and the Indian plate, Gondwanaland, to the south. From fifty to sixty million years ago, the stratified layers were uplifted from the floor of the Tethys into a number of parallel folds, called ranges (the Great Himalaya and the Lesser Himalaya). They took six or seven million years to attain their full height, while erosion continued to lower the surface.

The Himalaya ranges, the highest and the youngest mountain system of the world, spread in a gigantic crescentic form with the convex side facing the Indo-Ganga Plain almost uninterruptedly for a distance of 2,500 km, 150 to 400 km broad and covering about 500,000 sq km. They contain most of the world's 'eight thousander' peaks. Of the ninety-four Asian peaks which exceed 7,300 m, all but two are in the Himalaya and the Karakoram; and no other continent has peaks of this height.

Mt Everest (8,848 m) and Kanchenjunga (8,598 m) are situated in the Central Himalaya, covering the whole of Nepal. The Karnali, Gandak and the Kosi rivers drain this region. In

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eastern Himalaya, Darjeeling is well known for its tea gardens. The Cherrapunji plateau of the Khasi hills in NEFA is a classical example of a structural platform in India.

From the great Pamir complex, the Meru of the Purāṇas, the Tienshan-Kunlun-Karakoram, Himalaya and the Alai-Hindukush ranges splay out in the east and west direction respectively. The Alai-Hindukush are succeeded to the south by the lower ranges of Afghanistan and Baluchistan. North of this, the Sulaiman presents a steep face to the Indian Plain. The north-south Kirthar Range is on the Sind-Baluchistan border while the east-west Chagai hills are in north-west Baluchistan. Their echelonned ridges sink to the Seistan depression and swinging round east-west, parallel to the coast, is the Makran Coast Range. North-east from the great bend at Bunji, the country rises to Karakoram which in K_2 (8,610 m) has the second-highest peak in the world. The Karakoram and the Muztagh merge eastwards into the Kailash range, which is simply the high edge of the Tibetan Plateau overlooking the Indus-Tsangpo furrow.

The Patkai and other north-eastern ranges run to the south of the Assam Himalaya, along the Indo-Myanmar border and have an acute trend, the convex side pointing towards India. These are called Purvanchal.

Laddakh, the highest plateau of India (5,300m), occupies the north-eastern portion of the Kashmir Himalaya. It abuts the Krishnagiri and contains the remnants of an ancient Hindu civilization. Badrinath, the site of Hindu pilgrimage, is on the southern slope of the Great Himalaya (Himadri) in Garhwal. From here one can have a grand view of the peaks of Himadri, specially of Nilkanth.

The Shivalik or the Outer Himalaya: The eroded material of the high Himalaya filled the marginal sea or the secondary geo-syncline to the south of the ranges, out of which rose the Shivalik (also called the Outer Himalaya) up to a height of 600 metres above sea level. Between the Shivalik and the Lesser Himalaya (Himachal) there are flat-floored valleys called *duns*. The tertiary geo-syncline south of the Shivalik started filling with the detritus brought down from the Himalayan ranges to form the Indo-Ganga plain. The process is continued in the Bay of Bengal (which is a modern geo-syncline).

PLAINS AND RIVERS OF INDIA

Generally speaking, there are in India four principal *watersheds*. The Great Himalaya along with its Karakoram branch forms the first watershed in the north; the Vindhyan range in central India, strengthened by the Satpura Maikal, form the second. The Sahyadri is the third, which directs the courses of most of the Deccan rivers. The fourth watershed is the Delhi ridge which divides the north-Indian rivers into those joining the Bay of Bengal and those joining the Arabian Sea.

Himalayan Rivers

The Himalayan rivers have certain special characteristics. They cut the Great Himalayan Range and other ranges and form very deep gorges. From Bunji to Hazara the Indus flows in a great gorge, about 915-1,370 m deep. The headwaters of the Ganga (Bhagirathi and Alakhnanda rivers), Sarda (Kali), Ghaghra (Seti, Karnali and Bheri), Gandak and Arun also cut deep gorges in the ranges through which they flow. Another phenomenon associated with some Himalayan rivers is *river capture* (or *river piracy*). The Jhelum, Chenab and Sutlej display it in their upper reaches. In their lower reaches there have been cases of river migration. River migration studies have been conducted on the basis of data collected by remote sensing satellites. An extensive array of palaeochannel courses have been identified in the vast desertic tract of the Thar. From the existence of palaeochannels in the Ghaggar-Yamuna alluvium and

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THE NORTHWEST HIMALAYA

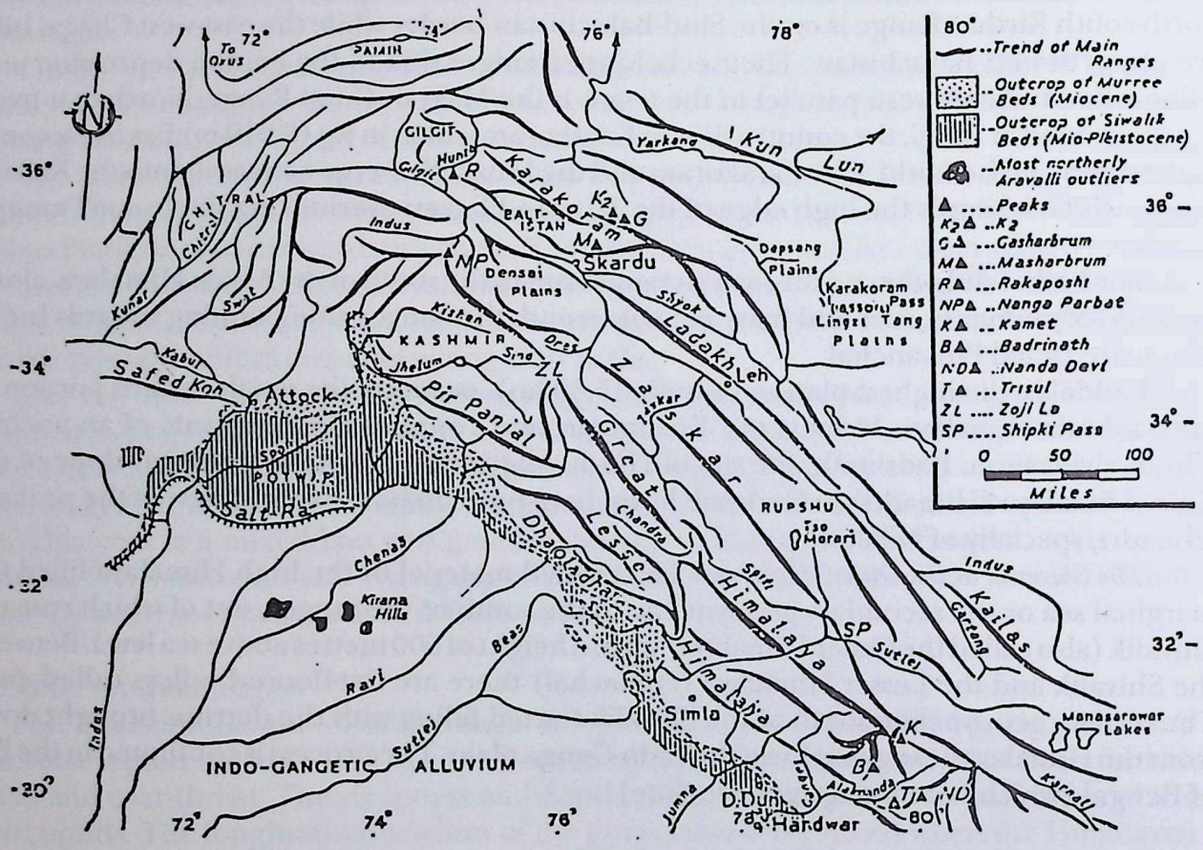

Fig. 2

the detection of fresh water aquifers in accurate form below the palaeochannels, it is concluded that the present Ghaggar river is the remnant of the Purāṇic Saraswatī river (also mentioned in the *Ṛgveda*) which migrated from east to west and finally disappeared in the Sind desert. Similarly, it was discovered that the Yamuna once flowed through Bharatpur and later migrated to Agra. The Chambal, Banas and Banganga also show similar signs. In the Great Ganga Plain also, there is evidence of the migration of the Ganga during the historical past. This behaviour of the Ganga and the Yamuna has mixed their fauna and so meets one of the points raised in support of the Indobrahm.

All the major rivers of the subcontinent have been eroding their banks extensively, bringing down vast quantities of detritus. The Ganga and the Indus carry some 100,000 tonnes of suspended material daily and the Brahmaputra more than either. Their source of water is not only from the monsoons but also the melting of Himalayan snows.

The *Ganga* is fed throughout its course by tributaries joining it in the plain where the annual rainfall goes on increasing as it proceeds towards the delta. This rain swells the flow and enables it to carry its load of silt much further than would otherwise have been possible. Heavy deposition takes place at the estuary, to form an extensive delta. There is a much larger area of fine silt in the Ganga basin and the 100-fathom line is much further out into the sea off the Ganga than off the Indus estuary. The Indus flows through semi-arid tracts in its lower

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reaches, hence its soils are generally coarser and the stream current does not carry enough silt with it for the formation of an extensive delta and continental shelf.

Among the Himalayan rivers, the Ganga is the most sacred for the people of India. They hold it in supreme reverence as a goddess. It is the Bhagirathi and Alakhnanda, coming from beyond the Great Himalaya in the Garhwal region and joining forces at Deoprayag, that form the Ganga. Emerging out of the Himalaya near Haridwar, it flows majestically for 1,200 km eastwards. Beyond Patna, it flanks the eastern face of the Rajmahal Hills. Near Dhulian, the waters divide: one branch passes into Bangladesh, the other flows through Indian territory as the Bhagirathi or the Hooghly and enters the Bay of Bengal at the southern tip of Sagar island. The eastern branch after its confluence with the Brahmaputra is called the Padma and joins the Bay of Bengal as the Meghna. Both the Indian and Bangladeshi rivers thus contribute jointly in making the extensive delta called the Sunderbans.

The bifurcation of the Ganga and its trend of eroding eastwards has created a problem of adequate flow of water into its western branch, i.e. the Hooghly. This much reduced discharge has resulted in heavy siltation in the Hooghly and Calcutta port which has been losing its economic significance. The construction of the Farakka barrage on the Ganga in Murshidabad District to store its water for diversion into the Hooghly in the lean season has been a cause of conflict with Bangladesh. The Ganga receives two important tributaries on its right bank, and three tributaries on the left bank, all snow-fed.

The Yamuna (a river mentioned in the epic *Mahābhārata*) flows for the greater part of its course between the high banks. With its major right bank tributary, the Chambal flowing from the central highlands, is divided at places by gully erosion and developing ravines. This is due to the uplift of the highlands during recent geological times. The Yamuna runs for 800 km parallel to the Ganga and joins it at Allahabad. The holy confluence is called Triveni (the now lost Saraswati constituting the third river to the confluence) or Sangam at Prayag.

The Indus (Sindhu) is another Himalayan river. It rises from a spring about 100 km north of lake Mansarovar and flows north-west through Tibet for the first 250 km before entering Kashmir where it cuts the Laddakh range three times. Flowing past Nanga Parbat, the river leaves Kashmir for Pakistan. In the last lap of its journey, the Indus traverses a sandy, semi-arid plain.

Except for the Indus and the Jhelum, all the other rivers that have made the plains of Punjab agriculturally productive rise in the Himalayas. The Chandra and Bhaga rise in Lahul and after passing over the Great Himalayan range, the united Chandrabhaga flows parallel to the Pir Panjal range. Entering Kashmir, it is known as the Chenab and flows for about 250 km. Another river of Punjab, the Ravi, also rises in Himachal Pradesh between the Pir Panjal and Dhaola Dhar range and then, cutting the latter through a deep gorge and again cutting the Shivalik range, flows through the plains of Punjab. The two other rivers that have their source in the Himalaya are the Beas and Sutlej. Of the five Punjab rivers, the Sutlej is the largest and the only one that has its source beyond the present Indian frontiers. Both the Sutlej and its tributary, the Spiti, lie north of the Great Himalaya and form a veritable canyon in the last fifty km of its course in the Tibetan plateau. It cuts through both the Great Himalayan range in a 5,000 m deep gorge and the Lesser Himalayan course down to the plains of Punjab.

The Dihang (or Siang), after its union with the Dibang and Lauhit, takes the name of Brahmaputra which rises from the snout of a glacier about 100 km south-east of lake Mansarovar. Near its source it is called Tachhog Khabab. It runs eastwards for 1,250 km in a shallow valley through Tibet, takes the name Tsangpo before making a sharp turn southwards and cuts through the deep gorge of Dihang.

The Lauhit river rises from Lake Lauhit in the Kailash region, from which, according to Swami Pranavanand, rises the Brahmaputra. This source river first enters a small lake (Lohita of the Purāṇas) and then enters the headwaters of the Brahmaputra.

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The Brahmaputra is the most important river of India from the point of view of the quantity of water that it carries unutilized. As its channel is not deep enough to carry the enormous volume of water that flows into it in summer, it overflows its banks every year in May, with the melting of the Himalayan snow, aggravated by the monsoon rains. The rise of water-level in the parent stream prevents the waters of tributary streams from entering into the main river, which leads to a rise of the water-level in the tributary streams, causing widespread floods. As the floods recede, marshy areas are formed near the confluence of the tributaries with the Brahmaputra.

Rivers of the Deccan

The major peninsular rivers are, as a rule, remarkably graded and have U-shaped valleys. They flow through relatively narrow corridors in broad uplands, and cut through the eastern hills in relatively constricted valleys. The Godavari, next to the Ganga, the most sacred river of India, rises near Trimbak in the Nasik District and flows through a deep 20 km long gorge over the Sahyadri before reaching Nasik town. In Andhra Pradesh, before it turns south, it receives two of its tributaries, the Wainganga and the Indrvati. In its southern course it travels in the Gondwana coal basin. Finally, it cuts through its own delta at Rajahmundry to reach the Bay of Bengal.

The Krishna rises near the Mahabaleshwar hill station and receives the Bhima as its left bank tributary and the Koyana, Ghatprabha and Malprabha as its right bank tributaries. Further south, rises the Tungabhadra, the Krishna's most important tributary. The great Nagarjuna Sagar dam has been constructed on the Krishna for irrigating vast stretches of arable land. Finally, the river turns sharply to the south, cuts through the range and enters its delta at Vijayawada.

The 760 km long Cauvery, known as the Dakshin Ganga, is the master stream of the Karnataka plateau. It rises from the Brahmagiri hill in the Coorg District and flows eastwards in a succession of rapids and waterfalls; the most picturesque of them are the Cauvery Falls around the little island of Shiva Samudram which has been linked with the great barrage at Krishnaraja Sagar. The river then enters the Tamil Nadu plains and finally reaches the Bay of Bengal through two distributaries flanking Srirangapatnam island.

The Damodar flows to the north of the Ranchi plateau in a faulted trough containing a number of Gondwana coal basins. It was considered the 'Sorrow of Bengal' and, like the Tennessee river, it is dammed at a number of sites to control floods and for eco-development, of the basin. Since large-scale industrial development, urbanization and population growth has taken place in the valley, it has become the most polluted river in the country.

The Narmada has its sources in Amarkantak in Madhya Pradesh. The straightness and relative steepness of the banks of its course from Handia to the Arabian Sea indicates the recent origin of this section. Below Handia the fall is 275 m in 483 km, the 790 km upstream falls just half as much. Possibly, the Narmada once flowed out through the Burhanpur-Khandwa gap into the present Tapi. Warping on a Handia-Paithan line would probably account for interruption of profile producing this aggradation. The rapids and the 15 m high magnificent Marble Rock falls (Dhuandhara), on the upper Narmada near Jabalpur, may be due to recent movement, or alternatively to superimposition. Below the falls, there is a 3 km long gorge. The landscape resembles that of the Danube river while passing through the Bohemian Plateau. Finally, the Narmada meets the Gulf of Cambay (Arabian Sea) through a 25-km-long estuary.

The Tapi rises from a spring on the Satpura range. Lower down, at Burhanpur it receives its principal tributary, the Purna, coming from the east through the cotton-growing plains of Berar and reaches the Arabian Sea west of Surat where it makes an estuary.

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MINERALS OF INDIA

Nature has been very kind to India in the endowment of mineral resources. In recent years many new mining regions have been explored. Of the various minerals found in India, the most important are coal, manganese ore, gold, mica, iron ore, and salt. India is the world's main source of ilmenite, monazite, zircon and mica. The partition of the subcontinent did not affect the Indian Union very much in the matter of endowment of minerals.

Indian minerals may be grouped as essential, strategic and scarce. Her position with regard to supply of industrial minerals is as follows:

1. Minerals in which India has an exportable surplus large enough to enable it to dominate ore world market are iron ore, titanium ore, and mica.

2. Among minerals of which the exportable surplus forms an important element are manganese ore, mangnesite, bauxite, refractory minerals, silica, and monazite.

The credit for discovering the presence of monazite in India in 1909 goes to a German scientist, C.W. von Schomberg. As rains erode the rocks in the Nilgiri and other adjacent hills, the particles are washed down and moved into the sea as sands. Some of these sands, as a consequence of the peculiar force of sea currents are swept back and deposited on the beaches. Monazite and ilmenite, zircon, garnet and silmenite are obtained from such sands.

3. Among minerals in which India may be considered as self-sufficient are coal, limestone, gold, aluminium ore, marble, sodium salts, and alkalis, dolomite, gypsum and nitrates, phosphates and zircon.

4. Among minerals for which India has to depend largely or entirely on imports are silver, nickel, petroleum, sulphur, lead, zinc, tin, mercury, tungsten, potash and copper. The position of India with regard to sulphur is serious. The principal lead mines in India are in Udaipur (Rajasthan). But there is no nickel and tin mined in this country and, consequently, India imports the former from Canada and the latter from Malaysia, Singapore and other countries.

India's high grade iron ore resources are perhaps the greatest in the world, with the possible exception of those of Brazil. The geographical distribution of iron ore in India is in Andhra Pradesh, Bihar, Maharashtra, Madhya Pradesh, Mysore and Orissa. The most important fields are in Bihar and Orissa. Most of the iron ore mines are close to coal fields.

Madhya Pradesh is the largest producer of manganese. It is found in Balaghat, Chindwara and Jabalpur districts. Copper bearing belt persists for a distance of some 100 km in Singhbhum where important fields like Mosabani, Ghatsila, and Dhobani supply the major portion of the Indian output. Copper ore also occurs in Khetri (Rajasthan) where it is now increasingly mined and refined. Gold is mainly used in India for ornamental, medical and chemical purposes. Its chief centre of mining is in the Kolar gold-field (Karnataka), where its production is decreasing sharply. India is the largest mica producing country in the world. Two principal states of its production are Bihar and Andhra Pradesh. Rajasthan sends its mica to Bihar for splitting and marketing. Salt is extensively produced from seas along the coast of Maharashtra, Tamil Nadu, Kerala and Andhra Pradesh. In Rajasthan it is produced from Sambhar Lake, the largest salt lake in the country, known for its inland drainage.

Coal and Petroleum

The two important fossil fuels in India are coal and petroleum. More than ninety-eight percent of the total output of coal comes from one big belt—the Lower Gondwana coal-fields (West Bengal, Bihar, Orissa, and Madhya Pradesh). Its important reserves are in Raniganj-Jharia, Son Valley and Wardha Valley, but the cocking coal is confined only to Jharia-Raniganj,

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Bokaro and Girdih. New coal fields are being discovered by mining experts in Bikaner (lignite) in South Arcot, Nepal Terai and Garo hills (Assam). The quality of coal is generally poor as it has high percentage of ash and moisture.

Petroleum is confined to a few places, e.g., Digboi (Assam), Sibsagar (Assam), Ankleshwar (Gujarat). Bombay High, and the Gulf of Cambay, with considerable gas reserves. It has also been prospected in Jaisalmer. India has to import a large quantity of oil as the home resources are very limited.

SOILS OF INDIA

Soil is the loose material of the earth's surface, consisting partly of mineral particles and partly of organic matter, in which plants grow. The mineral particles are usually weathered rock fragments modified by soil-forming processes. Some soils are 'rich', some are influenced by climate, or local parent material. If undisturbed by ploughing, soils tend to develop a succession of horizons from the ground surface downwards and the whole section is the *soil profile.*

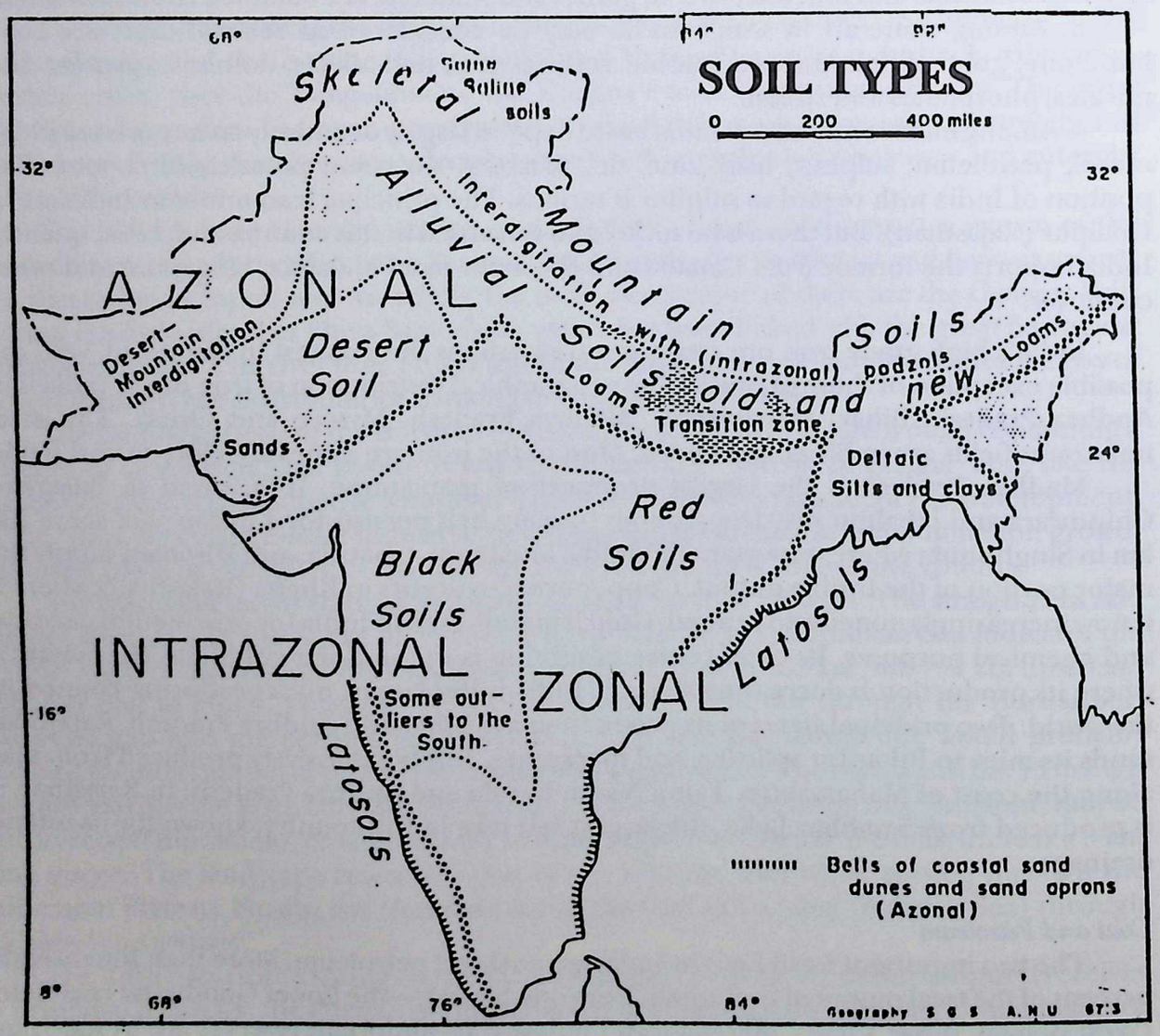

Fig. 3

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As a whole, the soils of India are of good quality. Eight soil regions are generally recognized in India, each dominated by certain soil types as follows: (1) alluvial soils, (2) black soils, (3) red soils, (4) laterite soils, (5) mountain and hill soils, (6) terai soils, (7) arid and desert soils, and (8) peaty and other organic soils.

Alluvial soils are the most important and occupy the plain areas of India. These are rich in chemical plant nutrients and are capable of yielding a large variety of rabi and kharif crops. They are, however, deficient in phosphoric acid, nitrogen and humus.

The black cotton soil, popularly known as *regur*, is well developed in the Deccan Trap of Peninsular India. It covers an area of about 200,000 sq km. Differential erosion of the basaltic traps and non-basaltic trappeans has resulted in the formation of the black soil which is so typical of this area. It is dark gray and dark brown in colour. The black soil is extremely moisture retentive. Primary crop associations are cotton, wheat and jowar on thicker soils and bajra and pulses on thinner layers.

Red soils occur in the whole of Tamil Nadu, Karnataka, south-east Maharashtra, and east of Andhra Pradesh and Madhya Pradesh to Orissa and Chhota Nagpur. It is also found in Santhal Parganas and the Birbhum District of West Bengal, Mirzapur, Jhansi and Hamirpur Districts of Uttar Pradesh and eastern Rajashtan. The rich, deep, bright red fertile loam of the plains produces a wide range of excellent crops. The red-soil areas are admirably suited for storage of rain water in tanks for irrigation.

Laterite soils are formed by weathering of laterite rocks. They are found in Andhra Pradesh, Assam, West Bengal, Orissa and along the Eastern and Western Ghats, especially in tea plantation areas.

Mountain and hill soils are suitable for the growth of forests. Terai soils are covered by tall grasses and shrubs of non-agricultural value. These are found in narrow strips in UP and Bihar, between plains and hills.

The arid and desert soils found in Rajasthan have a very low organic matter content. Certain parts of Kerala and Bihar have areas with peaty and other organic soils.

CLIMATIC CHANGES DURING THE PLEISTOCENE AGE

The Pleistocene period of geology is in many ways the most fascinating, though the briefest in the earth's history. It was during this period that the geography and topography of most parts of the world acquired their present outlines, and their fauna and flora in their present distribution. The period also embraces fluctuations of sea level and river action, and large changes of climate in regions far removed from the ice masses. Glacial episodes comparable with the Pleistocene glaciation have occurred more than once. Study of the glacial drifts has clearly established the occurrence of multiple glaciation, that is, of distinct glacial episodes, separated by warm inter-glacial intervals. Geologists in European countries have deduced four distinct and successive glaciations: namely the *Günz*, *Mindel*, *Riss* and *Wurm* glaciations, separated by warmer inter-glacial periods. It cannot be proved that the ice and snow completely disappeared from the higher mountains in these warmer intervals. There is considerable evidence tending to the important conclusion that the main glacial and inter-glacial were broadly contemporary throughout the world. There is also evidence of their occurrence in the Himalaya and in Peninsular India.

There is testimony of worldwide eustatic shifts, or high water-levels in the oceans, caused by summer melting of snow during the warm periods. It is estimated that the total duration of the glacial period is one million years.

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The Pleistocene Glacial Age in India

The Ice Age in the Himalaya: At many places in the Himalaya, there are indications of an extensive glaciation in the immediate past geologic age and that the present glaciers, though some of them are the largest in the world, are mere shrunken remnants of those which flourished in the Pleistocene Age. Enormous heaps of terminal moraines are now grass or tree covered, ice transported blocks, and the smoothed and striated hummocky surfaces and other indications of the action of ice on the land surface are seen in all parts of the Himalaya that have been explored, from Sikkim to Kashmir, at elevations thousands of metres below the present level of descent of the glaciers. In Pir Panjal, above 2,000 m, the mountains have a characteristic glacial aspect, while the valleys are filled with moraines and fluvio-glacial drift. On the southern slopes of the Dhauladhar range (1,433 m), an old moraine is found at an extraordinarily low altitude. Numerous small lakes and rock basins in Kashmir, Laddakh and Kumaun directly or indirectly owe their origin to the action of glaciers now no longer extant.

The sudden and widespread extinction of the Shivalik mammals is a most startling event for both geologists and biologists. The great carnivores, varied races of elephant, etc., which had found suitable habitats in the Shivalik jungles of the Pleistocene epoch, are to be seen no more in the immediately succeeding age. Maybe this was due to the inception of the intense cold of a glacial age.

Dainelli records four distinct phases of glaciation in the north-west Himalaya recognized by their moraines. Some indication of the oscillation of glacial and interglacial periods have been recognized in the heavy Pleistocene drift falling in the Sind and Lidar Valley of Kashmir.

De Terra has attempted a correlation of the moraines of successive glaciers with the Upper Shivalik stages of the Punjab. He believes that the terminal and the ground moraines of the Kashmir glaciers merge into the boulder-conglomerates of the foothills and with the system of terraces of the main valley of Kashmir. The system of lacustrine and river deposits known as *karewas* in Kashmir contain many of the terminal moraines embedded in them.

Ice Age in the Peninsula

On several isolated hill ranges, such as the Nilgiri, Anaimalai, Shivarai and other isolated plateaus in southern India, and on the mountains of Sri Lanka, there is found a temperate fauna and flora which do not exist in the low plains of southern India but which are closely allied to the temperate fauna and flora of the Himalaya, the Assam Range, the mountains of the Malay Peninsula and Java. Even on isolated peaks, such as the Parasnath in Bihar (1,373 m) and on Mount Abu, several Himalayan plants exist. There are connections between the Himalayan and peninsular regions. The most remarkable of these is the occurrence on the Nilgiri and Anaimalai ranges and on some hills further south, of a species of wild goat belonging to sub-genus of which the only known species inhabits the temperate regions of the Himalaya from Kashmir to Bhutan.

CLIMATE OF INDIA

The Indian subcontinent is climatically dominated by the tropical monsoons as the Tropic of Cancer passes through the latitudes of Calcutta and Ahmedabad. Its interior, owing to its continental nature, is subject to extremes of temperature. The Himalayan barrier not only influences the distribution of orographic rain in northern India but also protects the subcontinent from the cold Siberian winds from the north.

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The South-West Monsoon

Towards the end of May, north-western India and central Asia develop low pressure centres that draw the south-west monsoon from across the Equator, which strikes the Kerala, Malabar and Arakan coasts. The Western Ghat receives over 250 cm of rain from the Arabian Sea Branch. The Arakan and Assam hills arrest the Bay of Bengal branch and force it to rise up to an altitude of some 1,600 m and precipitate the entire moisture as rain. The neighbourhood of Cherrapunji is known to receive the highest rainfall in the world (2,300 cm in 1861). There is, of course, more rain along and near the Himalayan foothills than away from them. Hence Haryana, Rajasthan and Pakistan suffer from arid and semi-arid conditions.

The latter part of the south-west monsoon is marked by a gradual rise of pressure in northern India, which obstructs and, in relative terms, pushes back the Bengal currents. The south-westerly winds, therefore, appear to *retreat.*

The North-West Monsoon

During the winter season (December to February), the temperature reaches a minimum, especially in Punjab and north-west India, where a high-pressure centre develops which radiates north-west, north, and north-east winds. These are dry winds until they pass over Bengal, but onwards, steering from north-east when they pick up moisture from the Bay of Bengal, they precipitate it on the Madras coast and in Sri Lanka. During this period, some *cyclonic storms* also arrive from the Mediterranean Sea, travelling with the Westerlies. They provide light winter rains to the Kharif crops of northern India, where for dry farming it is called 'golden rain'.

During the successive months of March to May, the temperature rises steadily to a maximum, registering 43 to 49 degrees Celsius in the interior of the country. A low-pressure centre develops in north-west India from where strong hot winds known as the *loo,* blow down the Ganga Valley. It is only after this happens that the North-Eastern Trade Winds weaken and the moisture-bearing winds from the Indian Ocean start blowing from the south-west. Thus the summer monsoon breaks in the month of June.

INDIAN FLORA

Variability in the temperature and rainfall regime produces a great diversity in the vegetation of the subcontinent. The climate in general is suitable for woody growth, i.e. forests which show variations in their physiognomy, species composition, phenology, etc., due to local edaphic and biotic factors. Hooker (1855) considers climate as the main factor in distinguishing broad types of flora and has recognized nine floristic provinces of British India which then included the Malayan Peninsula, Myanmar, Sri Lanka, Pakistan and Bangladesh, as well as Nepal and Bhutan. In the Independence period, Razi (1955) has also attempted a classification of floristic provinces largely on the basis of climate, physiography, and migration routes. From the phyto-geography point of view, the classification by Chatterjee (1939) is still acceptable. The important features of the vegetation of these floristic provinces are outlined below.

Western Himalaya

This region comprises the area from Kashmir to Kumaun in UP. The annual rainfall ranges from 100 to 200 cm. Differences in vegetation are noticed in relation to altitude and accordingly three major zones are recognized:

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(a) *Sub-montane zone:* This extends up to 1500 m altitude and extends up to the Shivalik ranges. The forests are subtropical and consist of sal, *Salmalia malabarica,* dhak, babul, sain, *Anogeissus, Stereospermum,* bamboo, haldu.

(b) *Temperate zone:* In the zone above the sub-montane zone, up to 3,500 m altitude, the forests are typically montane-temperate as already described and are dominated by several species of cork oak, *Rhododendron,* betula, *Cornus,* populus, *Fraxinus,* pine, and deodar.

(c) *Alpine zone:* From 3,500 m to 4,500 m (the snowline), the vegetation is Alpine forest and scrub merging into meadows. *Abies,* betula, junipers and bushy *Rhododendrons* are among most common tree species. Only herbaceous vegetation remains near snowline.

Eastern Himalaya

This region is comparatively humid, experiencing more rainfall and less snow and higher temperatures. It comprises north-east India east of Sikkim. It is subdivided into three zones altitudinally:

(a) *Tropical flora zone* (up to about 1,800m): Characterized by tropical semi-evergreen or moist deciduous forests, with trees like *Shorea, Terminalia,* siris, bhillar, *Cedrela, Salmalia,* kathal, champa, *Dillenia* and *Dendrocalamus.*

(b) *Temperate flora zone* (1800 to 3,800m): Has typical montane temperate forest, dominated by oaks, champa, *Pyrus, Symplocos, Castanopsis,* at lower levels; and by conifers and junipers and also *Rhododendrons Arudinaria,* etc. at higher levels.

(c) *Alpine flora zone* (3800 to the snowline, 5000 m): Characterized by *Rhododendrons* and junipers with typical flora of Alpine forests and scrub, as already described.

The Indus Plain

It comprises the arid and sub-arid regions of Punjab, Haryana, Rajasthan, Kutch and adjoining areas. The vegetation is typical thorn forest in semi-arid regions, except in the Aravalis and is typical desert in the arid region. The common species occurring in this botanical region are *Acacia nilotica, A. senegal, A. leucophloema,* dhaura, *Gymnosporia,* khejri, Salvadora, Capparis, shisham, Albizzia, Euphorbia, Grewia, Tephrosia and Colotropis.

The Ganga Plain

This area extends over UP, Bihar, Bengal and parts of Orissa. It is characterized by sal in its tropical, moist deciduous and dry deciduous forests. Littoral mangrove forests are also present in the Ganga delta.

Central India

The teak forests of this region have been under heavy biotic pressure. Among other dominant species are *Terminalia, Anogeissus, Phyllanthus,* madhuka, mango, kachnar, salai, etc.

Malabar

Due to the high rainfall, this area forms a distinct vegetation zone of India. The forests are tropical evergreen in the extreme west, semi-evergreen towards the interior and subtropical or montane-temperate evergreen in the Nilgiris.

The Deccan Plateau

This zone extends over the whole of peninsular India. Teak is the most dominant species.

Assam

This region is characterized by evergreen forest. The bamboos are common. Abundant undergrowth of canes, climbers and shrubs are present, besides luxuriant growths of ferns and orchids. The pine forests of the region consist chiefly of *Pinus khasia.*

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INDIAN FAUNA

India has a rich heritage and unique variety of wildlife, as well as a long history and tradition of *conservation ethics* imbibed in the sylvan surroundings of the ancient *āśramas.* The first recorded game laws in India were promulgated by Kauṭilya in his *Arthaśāstra* in 300 BC. Different animals were associated with different gods and goddesses, and this provided them religious sanctity and ensured *eco-conservation.*

There are in India about 350 species of mammals, about 2000 species and sub species of birds and more than 20,000 species of insects. In modern times, many of the species are becoming rare and are threatened. This is attributable to *environmental change.*

In the perspective of the earth's history, India today forms a part of the Oriental Region. The fossil remains in the Shivalik throw a great deal of light on North Indian fauna during the Tertiary period. The present physiography and climate of India, together with the great faunal changes that took place during the late Pliocene period have imparted to its fauna a variety of habitat, each supporting its own distinct type of fauna. There are three major faunal regions: (1) Himalayan Mountain System, (2) Peninsular India and the Ganga Basin, and (3) the Tropical Evergreen Region. Each of these has its sub-regions.

Fauna of the Himalayan Mountain System

At high altitudes in the Western Himalaya, in Kashmir and western Laddakh to UP Kumaun, have wild ass, wild goat and sheep of different species. The largest bovid, the yak, has been domesticated for centuries but wild yak are still found. Musk deer is one of the species of the system and is much valued for its musk pods used in the manufacture of perfumes. Pikas, or mouse hare, live at altitudes from 2,500 to 4,000 m.

At lower altitudes, the Terai and Bhabar constitute one of the richest areas for the typical big mammals of northern India—elephant, sambar, swamp deer, cheetal, hog deer, barking deer, wild boar, tiger, wild dog, hyena, jackal, black and sloth bear, porcupine, one-horned rhinoceros (now confined in a few pockets of Assam and Nepal). Wild buffalo, Gangetic gharial and golden langur are unique to this area, and are found nowhere else. In Eastern Himalaya, three kinds of goat antelopes, red panda, badgers and crestless porcupines are typical species.

Fauna of Peninsular India and the Ganga Basin

This region is the true home of Indian fauna as it has the potential of supplying high ungulate biomass. Rain forest elephants, muntjac, sambar, wild boar and several species of deer and antelopes, as well as the barasinga, now an endangered species, all occur here. Among the other animals seen here are the wild dog, used in well-organized hunting parties, the tiger and the leopard.

Royal Bengal tiger (*Panther tigris, tigris*), now India's National Animal, is the most famous animal of both peninsular India and the Himalayan foothills. A special conservation project, 'Project Tiger' organized by the Government of India to protect this animal is in progress in collaboration with the World Wide Fund for Nature (WWF). The gaur (*Bosgaurus*) has an extensive range covering the entire Central India Plateau and extending into the foothills of the Himalaya, Myanmar, and Malaysia.

Fauna of the Tropical Rain Forests

The region of tropical rain forests comprising north-eastern India and the Western Ghat, including the Malabar Coast, has a host of animals, but its fauna and flora have not been explored fully. Big herbivores like the elephants and tree-dwellers like Hoolock gibbon (which is the only ape found in India at present) and other different kinds of langurs,

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including Nilgiri langurs, are also found. Bats are a widespread group of flying mammals. Also native to the area are giant squirrels, flying squirrels and Nilgiri mongooses.

The description of India's wildlife will not be complete without mentioning species to be seen in four specially interesting habitats: (1) the Andaman and Nicobar Islands, (2) the Indian Desert, (3) the Wetlands of Keoladeo National Park, and (4) the mangrove forests of the Sunderbans.

Andaman and Nicobar Islands

The fauna of the Andaman and Nicobar Islands derived the bulk of their species from the Indo-Burman and Indo-Malayan regions. On these islands and in the surrounding waters, there are thirty-five species of mammals, a number of interesting reptiles, and a variety of marine fauna. Bats, rats, Andaman pigs, crabs-eating macaques, various species of deer. There are a number of lizards and about forty species of snakes, including poisonous ones. Python is found in the Nicobar group. Among the marine species are the 'false' killer whale, the dolphin, the Nicobar pigeon and the white-bellied sea-eagle.

In the tidal creeks and the mangrove swamps all along the coastal areas of the islands, reside saltwater crocodiles, a threatened and completely protected species; and the green turtle which is quite common.

The Indian Desert

A large number of desert mammals (e.g. the camel) and other desert vertebrates have evolved remarkable physiological adaptations to conserve water. They have efficient kidneys which secrete highly concentrated urine and specialized intestines that remove water from faecal material before it is excreted.

Rodents probably represent the largest group in the mammalian fauna of the desert. Gerbils live on perfectly dry food with no water content at all. All their body fluid is derived from metabolic water. The wild ass lives in the salt flats of the Little Rann of Kutch and the black buck of the same area is protected by the Vishnois of Rajasthan. Snakes, lizards, and tortoises are well represented in the desert. Snakes are nocturnal. Burrowing animals live underground. The great Indian bustard is a large, beautiful and omnivorous bird, and inhabits the desert fringe.

Keoladeo National Park

Situated at a distance of 156 km from Delhi and Jaipur and only 50 km from Agra is a vital haven for water birds, called Keoladeo National Park (formerly known as Ghana). Nearly 328 species of birds have been identified in this region of which 110 are migratory. There are breeding birds among the winter visitors; large numbers of geese, ducks and white pelicans. The most sought for is the white 4.5 foot high Siberian crane whose conservation is a major concern of the International Crane Foundation. A ten-year research project on the birds of this park was completed in 1991 under a collaboration between the US Fish and Wildlife Service and the Bombay Natural History Society. On investigation it is discovered that a number of Siberian cranes are killed at their halting sites on way from and to Keoladeo.

Mangrove Swamps of Sunderbans

At low tide, the exposed mud flats and shallow waters here are invaded by armies of crab and fish. On the mangrove trees live numerous weaver ants. In higher regions of the mangrove forests, live spotted deer, pigs, monitor lizards and monkeys. Rhinoceros, swamp deer, and wild buffalo are no longer seen in the Sunderbans, but Sunderban tiger—the 'man-eater', still roams its forests under the watchful eye of the Sunderbans branch of the Project Tiger.

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NATURAL REGIONS OF INDIA

India can best be divided into five macro natural regions on the basis of geomorphology, climate, drainage and other important natural features as follows:

1. The Great Mountain Wall
2. The Great Lowland in the North
3. The Great Plateau of Peninsular India
4. The Coastal Plains
5. The Islands

The division of India into five regions is as old as the *Atharvaveda* (XIX 17.19). Buddhist writers like Yuan Chwang and the author's of the earlier texts also follow the same division. The *Mahābhārata* also describes the five divisions in detail and the last three Purāṇas agree with it.

The Great Mountain Wall

Himalaya means the home of snow and the snowline is the level on mountains above which snow never disappears or the lower limit of perpetual snow. On the southern face of the Himalaya, the snow line is lower while on the northern face (Tibetan, drier side) it is higher. The valley glaciers in the Karakoram are the largest in the world outside sub-polar regions. The Fedchenko in the Pamir and the Siachin are 77 km and 72 km long respectively. The largest glacier of the Garhwal Himalaya is the Gangotri, 30 km long and 3 km wide. The western glaciers (e.g., in Kashmir) are not only larger than those of the centre and east but they also descend to lower levels. The Himalayan glaciers provide approach routes to Himalayan peaks, e.g. Mt Everest, Kanchenjunga, Nanda Devi, K_2 and others.

The Great Mountain wall varies enormously from end to end, specially in climatic conditions. The elevation and spacing of the ranges also play an important part in the differentiation of the mountain ranges into distinct regions. In the north-eastern corner of Assam, they are highly packed folds, known as *patkar*. They broaden out to form the Naga hills bifurcating into the Garo, and Khasi and Jantia hills.

The Great Himalaya has Alpine pasture lands which can be used seasonally. In the western Himalaya, the Pir Panjal range is the site of temperate forests containing broad-leaved oak, needle-shaped pines and deodar. Their logs are floated down the rivers. Its northern slopes are covered with terraced fields of fruit trees like mulberry.

Through the broad valley of Kashmir, between the Great Himalaya and the Pir Panjal passes, flows the Jhelum. It contains the Wular lake on which international tourists enjoy their stay in house boats and recreate themselves in shikaras—beautifully decorated boats. Tourism and trade in Kashmir are suffering at the moment due to international terrorism in the Kashmir Valley. Wular Lake, which once covered the whole valley, is now shrinking alarmingly. Water-power is the most potential resource of the region. Limestone, gypsum, bauxite, graphite and dolomite are the minerals found here. Much of the forest wealth of the Punjab and UP Himalaya has been depleted. Chirpine, bamboo and sabai grass are obtained from the Shivaliks.

Further in the east, in the Darjeeling-Sikkim-Bhutan belt, the Himalayas rise very abruptly from the Great Plain. Here is the Kanchenjunga peak (9,300m) and several passes leading to the Chumbi Valley, an important gateway to Tibet. This region promises water power potential and a belt of sal and oak forests.

In Assam, the north-south gorges of the rivers Dihang, Dibang and Lauhit mark the termination of the west-east trend of the Himalayas. More than 20 per cent of the total hydel

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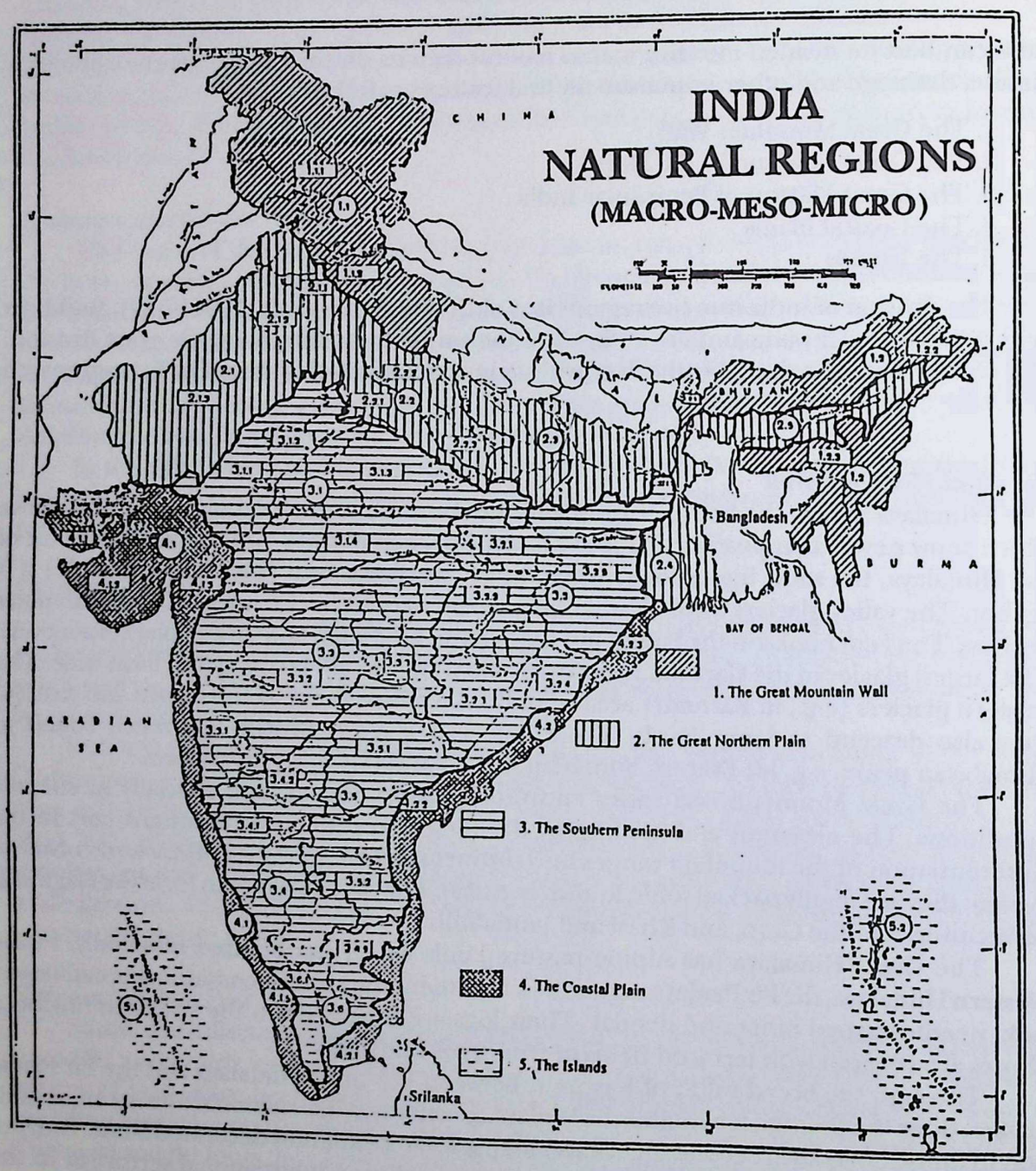

Fig. 4: Natural Regions of India
1. *The Great Mountain Wall.* 2. *The Great Low Land in the North.* 3. *The Peninsular Plateau.* 4. *The Coastal Plains.* 5. *The Islands. These are the macro natural regions. The boundaries of meso and micro natural regions are also shown and noted within the circles.*

power potential (24 million KWhs) of the Great Mountain Wall is found here, in this part. More than 75 per cent of its area is still under forests ranging from tropical to temperate.

The southern slopes of the Shillong plateau are directly in the path of the monsoon current, with the result that they are noted for recording the heaviest rainfall in the world. Shillong plateau and the eastern hills contain the largest resources of coniferous trees and bamboo in India, half of which is located in the Mizo hills. These can be floated down the rivers to Cachar District of Assam. The hill tribes have destroyed vast areas of forests for shifting

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agriculture (*jhum* cultivation). Oranges and pineapples are grown in abundance on the southern side of this plateau.

The Great Lowland in the North

The Great Plain of India is remarkably homogeneous and the most important type of land-form from the standpoint of human use. It is the most densely populated alluvial plain in the world. On this vast aggradational surface covering nearly one-fifth of the total land area of India, the only marked topographical changes are those associated with the numerous shifts and diversions of the rivers. The Vale of Kashmir, the Imphal basin in the Manipur hills and the Nawng Yang basin of the Patkai range are typical examples of lacustrine plains—ancient lakes subsequently filled up to their present position. West of the Aravalis are the rocky arid plains of the *hamada* type, specially near Jaisalmer town. The regional differences in topographical details are slight but climatic variations from west to east are marked.

'Along the outer slopes of the Shivalik there is usually a fairly steep talus gravel slope, the *bhabar*, in which the larger streams lose themselves, seeping out lower down in the marshy, jungly, and naturally intensely malarial Terai strip.' (Spate and Learmonth, 1984). The older alluvium is known as *bhangar* and as a rule occupies higher ground than the recent *khadar* which occupies the flood plains and grades into the most recent deltaic silt. In the *bangar* there are irregular, limey concretions (*kankar*). In the drier areas of Uttar Pradesh and Pakistan, there are stretches of barren saline efflorescence known as *reh* or *kallar* which spreads specially with the spread of irrigation. This most serious problem started in Pakistan. Now it has extended into Indian Punjab, Haryana and UP. Quite lately it is being experienced in Rajasthan also in the Ghaggar depressions and the Indira Gandhi Nahar command area, resulting in the problem of water-logging.

The fertile alluvial soils of the Punjab plains, with the help of winter rains, ground-water and canal irrigation, fertilizers and pesticides, coupled with mechanized agriculture, have turned them into rich park land and brought about a Green Revolution.

The Upper Ganga plain stretches from Delhi eastwards up to an imprecise boundary running from Allahabad to Faridabad. It is limited to the sub-Himalayan strip in the north and the Yamuna river in the west and south.

In the middle Ganga plain which extends up to Bhagalpur in Bihar, the climate is less extreme. The rainfall varies from 1,000 mm to 1,500 mm. Rice and jute are added to the list of crops. The rivers in this part have been tamed by multipurpose projects. This region has potential reserves of limestone, mica, china clay and dolomite.

Beyond the Chhota Nagpur plateau is the delta plain of the Bhagirathi and the Brahmaputra which is subject to floods during the summer monsoon. Rice and jute are the dominant crops. Tea is grown in the north terai part. Here are belts of deciduous and evergreen forests and mangrove swamps of the Bay mouth. The Gondwana rocks in the Damodar Valley are associated with the coal reserves. Manganese has also been discovered in this region.

The Peninsular Plateau

The Peninsular plateau covers about one-half of the country. In the north-west are the Aravali hills endowed with metallic minerals and small basins of interior drainage like the Sambhar Lake. It is subdivided into a number of smaller plateaus.

The Malwa plateau, a dissected lava plateau extending up to the Son Valley in the east and Indore in the south, has a sub-humid climate and denuded deciduous and teak forests. The hydel-power potential of the Chambal has been harnessed. The mineral resources in the Bundelkhand region are limestone and bauxite. It has a very thin soil or bare rocky surface. Cotton and millets are the main crops. Diamond is mined in the Panna District of MP.

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In the north-eastern part is the Baghelkhand-Chhatisgarh plateau. It is densely forested with sal and teak, and is known as the rice bowl of Madhya Pradesh. Bamboo, sabai grass, and lac are important forest products. Hirakud Dam is built on the Mahanadi and there is a thermal power plant at Korba. The entire Chhota Nagpur plateau is by far the richest mineral belt in India. Here are the deposits of iron ore, coal, limestone, dolomite, bauxite, manganese, mica, thorium, uranium, etc. Despite these rich mineral resources, the area has remained inaccessible and is inhabited by backward and poor tribals.

In the western part is the Maharashtra plateau, a region of extraordinary physical homogeneity because of its characteristic lava rock. The western Ghat is clad with luxuriant tropical forests but mostly denuded in recent decades. It has very rich hydel-power potential, most of which has been developed. The more mature black soil occurs in the Tapi valley. Cotton and millets are the predominant crops. Canal irrigation has been widely developed. The Karnataka plateau consists of Archaean gneisses and granites and is drained by the Bhima, Krishna and Tungabhadra rivers. It is divided into the highly forested Malnad in the west and the Maidan in the east. The Malnad area has important metallic ores, such as iron-ore, dolomite, manganese ore and bauxite. The Rayalaseema plateau is one of the driest tracts in the peninsular plateau. The Nilgiri plateau has a rainfall of 1,500-4,000 mm and dense forest. The Tamil Nadu plateau possesses a wide variety of minerals concentrated in the Salem and Coimbatore plateaus.

Coastal Plains

The coastal plains are a long strip of alluvial soil hemmed in between the sea and the Ghat area. The coast on the west is narrow and the Ghat rises steeply from the plain. In the east it is wider at points where the Mahanadi, Godavari, Krishna and Cauvery rivers have formed great deltas and the Ghat behind it is neither a continuous range nor very high in altitude. The west coast is extremely wet. The east coast on the other hand is drier.

The northern part of the west coast is called the *Konkan* coast. It is 528 km long and 48 to 80 km wide and offers good sites for generating hydel power. Rice and coconut are grown on the entire coast. Bombay, the only natural harbour in the country, dominates the entire coast. Its industrial minerals include iron ore and manganese ore in Goa and bauxite in Kolaba.

Further south is the *Karnataka coast* and in Kerala the *Malabar coast* where forestry remains a major source of wealth. Here teak plantations are being developed. Rice and coconut are the dominant crops and fishing plays a dominant role in the life of the coastal people. Among the minerals, ilmenite, monazite and zircon sands are found in its Travancore beaches. This area is facing the problem of lagoons and backwaters, as well as of marine erosion.

The Kutch coast is for the most part barren, rocky and treeless, like the Thar desert. Nevertheless, it is bestowed with bauxite, limestone and lignite resources. The Kathiawar coast has some of the richest fishing grounds in the country. Fish and salt are part of the marine wealth exploited so far. The Gujarat coast is one of the most important cotton tracts of India. Ankleshwar is known for its petroleum deposits.

The east coast is termed the *Coromandal coast* and has no natural harbour. Madras is an artificial port. Its most productive area is in the Cauvery delta where a surplus paddy crop is raised by irrigation from the water released from the Mettur Dam. On the Andhra coast the Godavari and Krishna have formed a compound delta where rice and tobacco are the main crops. Further north, on the Orissa coast, jute and paddy are grown on the Mahanadi delta, which has become another important jute and paddy growing centre of India. At the mouth of the Mahanadi river, Paradeep port has been developed to export the iron ore of Orissa to

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Japan, and further north on the West Bengal coast, Haldia Port has been developed as a supplementary port to Calcutta.

The Islands

Off the southern peninsular coasts there are groups of islands which deserve treatment as a separate physical unit. About 240-480 km away from the Malabar coast lies a group of atolls in the Arabian Sea stretching from the equator to 15° N latitude. They are the *Laccadive, Minicoy* and *Amindivi* islands owing their origin to the accumulation of coral detritus on the submarine swell. These are small islands fringed with groves of coconut palm. Only ten of the islands are inhabited, the rest being too small and isolated.

Another group of islands—the *Andaman* and the *Nicobar* lies in the Bay of Bengal about 944 km from the Hooghly mouth. These appear to be the outcrops of the hill ranges on the country's eastern border with Myanmar. The area of the Nicobar group of nineteen islands is 1645 sq km. In the north there is a flat coral covered island, and in the south it is mountainous. The area of the Andaman group of over 220 islands is 6475 sq km. East of the Andaman islands is a small active volcanic mountain named Barren Island.

The main resources of these islands are the dense tropical forests which include first-grade timbers for export to Europe. The coral reefs and dead shells afford a rich source of a very high quality of lime. Sea cucumbers and ornamental shells are exported from these islands.

The population of the aboriginals (e.g. the Onges of Little Andaman) is at the verge of extinction while that of the rehabilitated Indians (refugees from Bangladesh) is on the increase. The Port Blair is being developed rapidly.

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CHAPTER IV

Human Geography of India

Indra Pal

HUMAN GEOGRAPHY

Human geography is the science of the location and spatial distribution of man and his works. It may also be described as human ecology. One school of thought sees human geography as the science of societies. Its foundations were laid by the *Die Erdkunde* (1822 ff) of Karl Ritter and the *Anthropogeographie* of Friedrich Ratzel (1891). Paul Vidal de la Blache (1931) founded the modern French school of the subject. Huntington (1934), an American human geographer, who has popularized the study in the English speaking world, explains, by means of the study of various natural factors, man's economic life and the state of civilization reached by different communities. He holds that a temperate maritime climate is the most favoured by nature and the most suitable for supporting the higher forms of civilization. This, however, is a conclusion drawn from the study of the modern world; the situation was very different in the ancient world, in which the river valleys in the subtropical zone were most congenial for the development of human civilizations like those of the Indus Valley, the Nile Valley and the Mesopotamian Valley. Maybe, in those times, the climate in these valleys was relatively temperate and humid. Human geography therefore seeks to acquire a scientific understanding of the distribution of terrestrial phenomena, whether natural or man-made, and of the processes by which these distributions have occurred and are changing. This scientific knowledge can be used either to increase our returns from the natural environment, to decide upon a good location for some addition to the built environment, or to plan the rational distribution of new artifacts. Hence, economic geography and political geography may certainly fall within the scope of human geography which has a connection with both history and social geography. It may be recalled that many historians from H.T. Buckle (1857-61) to F. Braudel have argued that historical phenomena are determined by geographical factors. Their works, however, are primarily interpretations of history, not scientific accounts of geography.

Unity in Diversity in India: Geographical and Cultural

Though Hinduism has given a certain tone to most of the subcontinent, it contains within itself a vast range of diversities – not only the enclaves of primitive tribes but also followers of ancient faiths such as the Jains, the Buddhists, the Parsees, the Jews of Maharashtra and Cochin, the Syrian, Nestorian, Catholic and Protestant Christians and the followers of Islam which came from Arid Asia. For millennia the Indian Peninsula has been virtually a cul-de-sac into which peoples and cultures have infiltrated or been driven, retaining much of their

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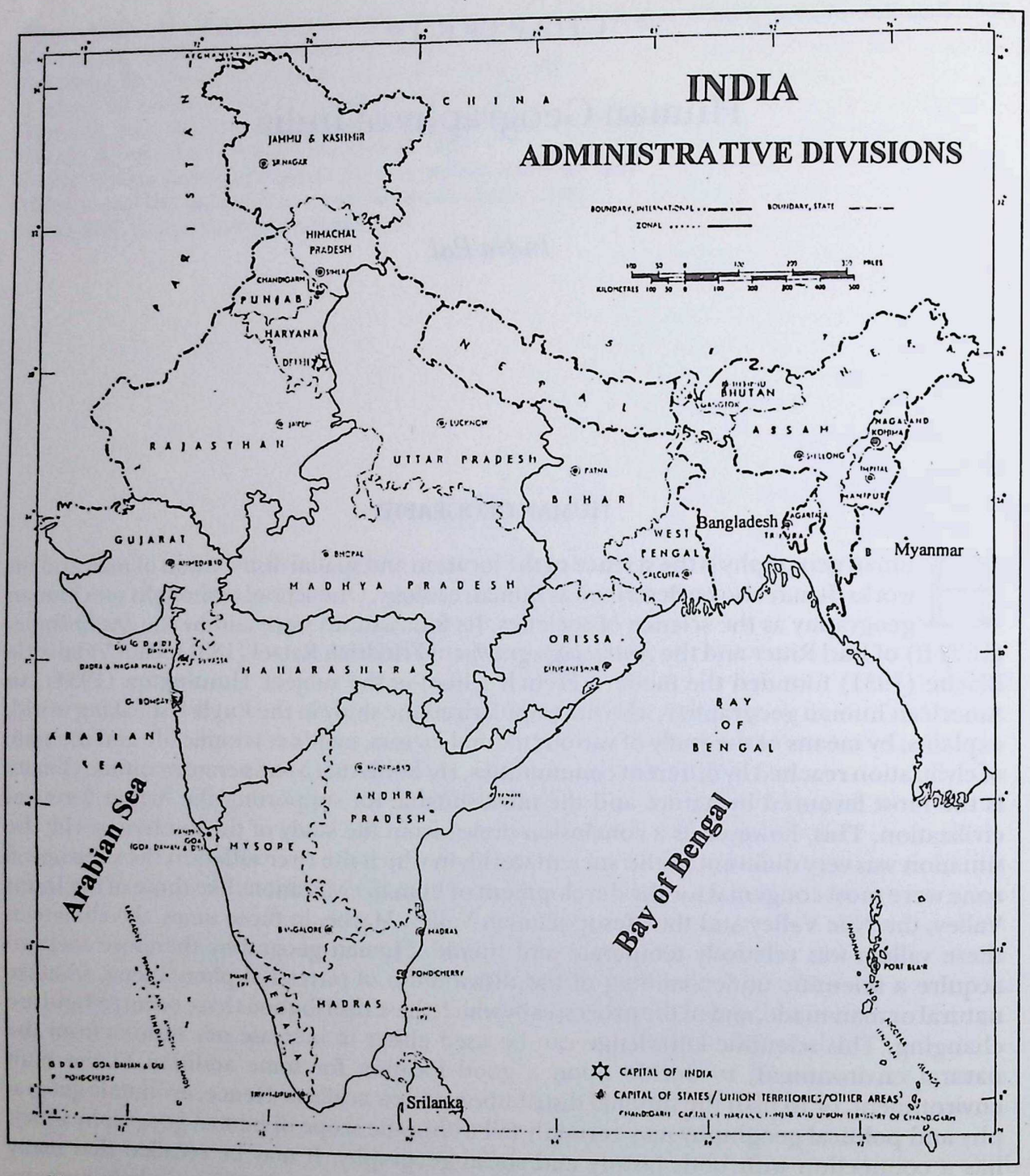

Fig. 1: State Reorganization Commision (1955) formed linguistic states. A few new states like Gujarat, Haryana, Himachal Pradesh, Meghalaya, Arunachal Pradesh, Mizoram, etc. were parcelled out later on.

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ancient rules of life and yet ceaselessly reacting with one another, and for the most part if not wedded together at least held together in the iron clasp of a community system of which the caste system is the prime example. Among the people of India are groups at all levels of economic development, from the Stone Age to that of monopoly capitalism. This human heterogeneity is seconded by more purely geographical factors, which give to India its unique character as a subcontinent. As a demographic unit, the subcontinent, and indeed India alone, ranks second only to China. It contains, in outer Kashmir, tens of thousands of square kilometers of desert almost devoid of inhabitants, while in Bengal, one of the world's most densely inhabited areas – the plain and the delta of the Ganga and Brahmaputra. It has the most massive mountains of the world, intersected by rivers of the first order. The three macro-regions of the subcontinent – the Extra-Peninsular Mountain Wall; the Indo-Ganga Plains; the old Peninsular Bloc – contain a multitude of distinctive *pays* within themselves. It is aesthetically fitting that the historic heart of India, the great node of Delhi, should lie on the divide between the Indus and the Ganga. The roles of the Himalayas and the sea in shaping the traditional image and historical vicissitudes of the country have been highlighted more than once, for example, by K.M. Panikkar (1955) and R.C. Majumdar (1971).

Overarching these geomorphological diversities is one great common physical factor: the rhythm of the monsoon system. The people of the entire subcontinent are predominantly agrarian and dwell in lakhs of villages, their destiny controlled by the seasonal cycle of monsoon and, nearly everywhere, the fundamental lineaments of the patterns of their life-style are similar. Though nearly half of the area and half of the population lie north of the Tropic of Cancer, yet all of the subcontinent south of the Himalaya is essentially warm tropical. The agriculture outside the Himalaya is nearly everywhere tropical in type, and it is rain, and not temperature, that essentially decides what crops shall be grown.

Culturally also, the whole subcontinent is one, under an all-pervading civilization which goes back to the most ancient roots traceable to the age of Mohen-jo-daro and Harappa, Kalibangan, and Lothal. The four *Pīṭhas* of the Śaṅkarācāryas in the four corners of India and the practice of visiting them at least once in the lifetime of every Hindu is another example of the unity of Indian culture. So are the bhakti cults with followers spread all over the country. The tradition of making offerings of rice, coconuts, areca-nuts, etc. – all products of the coastal areas – to the gods was spread inland and all over the subcontinent by devotees from coastal areas visiting pilgrim centres. This process continues till today, the great, progressive integration of North and the South, overcoming all barriers of caste, creed and language. The *tīrthas* are distributed all over the country. The holy bath at Haridwar, at Prayag, at Kurukshetra, at Nasik and at Ujjain during the Kumbha, drawing millions of devotees from all parts of the country, is unparalleled anywhere else in the world. Could there be a better example of unity in diversity than in the Indian subcontinent?

At the micro-level, zones of friction are to be found, for example, between mountain dwellers and peoples of the plains; between nomadic pastoralists and settled populations; between trading groups established on the banks of the rivers or on the sea-coasts and landowners of the interior; between the people of the forests and the people of the steppes; between the highland shepherds and the tree-owners of the well-watered valleys. However, grouping together, they help establish a great democracy. Thus, nature has provided both the essential elements: (a) a group of human beings of varying ethnic relationships, yet claiming an overall high level of common civilization, and (b) a territory structured by the features of its physical geography, closely linked in the organization of the State.

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I. INDIA'S NATURAL RESOURCE POTENTIALS

'Resources are not, they become.' Any element on this earth becomes a resource only when it is utilized. The resources which man extracts from nature are either renewable or non-renewable. Soils and water are renewable, while minerals are non-renewable. Exploitation of minerals encourages industrial growth. India's richness in both renewable and non-renewable resources is apparent from the saying, India is a golden bird. Till independence was attained, these resources were to a great extent in a potential state. Only some of them are even now in the process of utilization. The types and distribution of minerals have been described in the chapter on Physical Geography of India. New minerals are being explored and surveyed and added to the list of resources.

Soil Resource

The most intensively utilized resource in India is the soil. Three-fifths of the teeming millions in India earn their livelihood from the exploitation of this renewable resource. About 45 per cent of the total land area in the country is utilized for crop farming, about 3 per cent for pasturage and live-stock farming, about 18 per cent for forest plantations and orchards. The soil is deteriorating in the absence of adequate manuring, loss of micro-nutrients, and unscientific application of fertilizers. The gradual thinning of the forest cover and increasing pressure of population on the soil have been well established trends in Indian history.

Water Resource

The annual rainfall in India contributes more than 370.04 million hectare metres of water of which 123.35 million hectare metres sinks into the soil, and 166.52 hectare metres flows into the river systems. The entire surface water cannot be utilized because of flow characteristics, climate, and soil conditions. It has been estimated that only 55.51 million hectare metres of surface water is available for different uses. The reserves are being explored, including in the heart of the desert. A tremendous amount of fresh water has been discovered in recent times by remote sensing techniques under the lost channels of the Vedic Saraswatī in Jaisalmer District.

The northern part of the country has a higher water resource potential than the southern part, thanks to its large number of snowfed rivers and canals which are perennial. Shortage of water for irrigation is a serious challenge in the western part of Rajasthan and the Kutch area. The Indus Basin has utilized almost its entire irrigation potential. Tamil Nadu and Kerala have very little scope of expanding irrigation. The Ganga Basin has about 40 per cent of the total Indian irrigation potential but utilizes only a fifth of this.

Energy Resource

Prior to the twentieth century, energy in India was derived mainly from farm waste, fuel woods, and dung, but in the twentieth century, within a few decades, coal, oil, natural gas and water power became the country's major sources of energy. In 1960-61, coal contributed 61 per cent of India's total commercial energy-generation, hydel power 34 per cent and oil and natural gas only about 5 per cent. Of course, when fossil fuels (coal, oil and natural gas) are, in the course of time, used up, the other possible energy resources in the country would be the potential hydel and atomic power. The country's power potential so far estimated is 41.2 million KW. Atomic energy, wind and solar energy, and the tidal energy of the sea, may supplement water-power energy. Atomic power which is competitive even today may become a very cheap source of energy when thermal nuclear fusion would yield energy many times that now provided by fossil fuels. India's reserves of atomic minerals are perhaps, the largest in the world. Extensive monazite deposits containing no less than

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306,000 tonnes of thorium have been discovered in Bihar in a concentration of over 10 per cent. The total thorium reserves discovered in various parts of India are equivalent to the total reserves of uranium in rest of the world.

It might be mentioned here that India has numerous non-fuel minerals also, including all those required for developing a complete metallurgical cycle for the ferrous industry.

Wasteland Resources

Out of India's total geographical area of 329 million hectares, 145 million, 45 per cent, is under plough. Of the remaining 184 million hectares, about 75 million is under forest cover, which is another important resource. But this resource has been depleted or destroyed recklessly. Of the country's area, 33 per cent is ideally reserved for forest cover for economic exploitation under scientific management. Of the remaining, about 75 million hectares is wasteland. Wastelands are classified into different types, which have been identified and mapped by remote sensing techniques. In a country where population is increasing at an alarming rate, technology has to be developed to bring wastelands under utilization in one form or another.

Marine Resource

The Indian Ocean is a great economic resource for India. This almost enclosed ocean, along with the closed Persian Gulf and Red Sea on the north, as well as the triangular shape of the Arabian Sea and the Bay of Bengal strengthen the monsoon, which provides an annual supply of water which provides support to a vast population. Though it is the least studied of the oceans, the Indian Ocean has the distinction of having supported navigation and trade since ancient times. The myth of *Sāgara Manthana* symbolizes the ocean as the source of riches. The Harappans had intensive knowledge of the oceans and built a shipyard in Gujarat. This is indicated also by the discovery of submerged cities. Oceanic trade continued to flourish in ancient India when ships laden with goods from the Roman empire and south-east Asia crowded its famous ports like Muziris and Suppara.

India has 5,700 km of coastline, a continental shelf of 25,000 sq km and large number of gulfs and bays, indicating marine resource potentials. International shipping, fishing, use of seaweed as vegetarian food, are all possible thanks to the sea. There are 30 desalinization plants worked by solar energy along India's coastline. Offshore, the sea beds are rich in mineral wealth, including high quality diamonds. Seaside resorts attract tourists for recreation.

Nuclear Areas, Geographical Lineaments and Refuge Areas

The map (Fig. 2) shows how Spate has attempted to illustrate areas of relative permanence in Indian history from the age of Aśoka to Aurangzeb. These locations have been characterized as nuclear area, implying thereby that they are areas providing favourable locations for perennial bases of power which have endured from ancient times till today. Ancient Indian geographers recognized these areas as *Mahājanapadas* or *Janapadas*. These natural regions and/or territories are each characterized by homogenous geographical features demarcated from adjoining areas by certain relatively insurmountable structural lines having their own directions. Many such areas in the subcontinent have preserved their historic individuality and are perennially significant in Indian historical geography. The 'non-nuclear' areas termed 'refuge areas' not only preserved their original tribal population but also gave shelter to the tribes displaced from the nuclear areas by invaders. The 'refuge areas' roughly correspond to ancient *janapadas* called *pratyanta, parvatāśrayinaḥ* or *vanavāsinaḥ*.

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The three distinct geo-political and historico-cultural divisions of the Indian subcontinent are:

1. The Indus Valley, open to cultural and political influences from central and south-west Asia. It roughly corresponds to ancient *Saptasindhu* or *Uttarāpatha.*
2. Hindustan, or ancient *Madhyadeśa* separated from the Indus Valley by the Aravali range and the Thar Desert, It is accessible only when the 'Delhi gateway' is forced.
3. The Peninsula, south of the Narmada (a physical barrier of mountain ranges clad with dense forests) which, except in Maharashtra, has been resistant to influences from Central and West Asia. It corresponds to ancient *Dakṣiṇāpatha.*

Just as Khyber and Bolan give access from West and Central Asia to Saptasindhu, the Delhi Gateway provides an entry into Hindustan, and the Malwa gap a great passageway from Hindustan into the Deccan and vice versa. The Malwa plateau provided a passage to such northern conquerors as the Mauryas and Mughals, but also to the Rāṣṭrakūṭas and the Marathas from the Deccan. Even today, the trunk railway lines from and to Delhi pass through the Malwa plateau. Thus, it is not just the chance occupation of geographical space but mainly the physical barriers that have compartmentalized the subcontinent into the perennial nuclear power areas and refuge areas.

Besides the aforesaid major *janapadas* of Saptasindhu and Madhyadeśa (Hindustan), there are a few relatively less permanent ones in the Deccan and the far south, like the Kaliṅga (Orissa), Andhra (Telugu), the Chola and Pāṇḍya Tamil Kingdoms, and Kerala or Malabar in the isolated south-west littoral. Bundelkhand, Chhatisgarh, Konkan, Kanara, Khandesh (between the Narmada and the Tapi), and the Raichur Doab between the Tungabhadra and the Krishna are a few examples of still smaller nuclear areas. These and other areas like the ancient Matsya and Vidarbha are areas of conflict even in states formed on a linguistic basis after independence was achieved.

These perennial nuclear regions are not only natural but are also economically, socially and culturally advanced. Originally primarily agricultural, they are now also relatively advanced scientifically and technologically. They are also isolated from each other by negative areas like the arid region of Rajasthan, the forested hill and tribal areas of Gondwana country, the Rajmahals in western Madhya Pradesh and Maharashtra, and the Nilgiri Hills, home of aboriginals and tribals. These are the areas where economic resources and infrastructure still need much development. It is their most inhospitable natural environment that makes the chances of ameliorating their socio-economic condition difficult. Such, for example, is the case of much of Kashmir in the North-west and the North-east Hill region.

Even the frontiers of most northern empires were not pushed towards the south beyond the Narmada-Chhota Nagpur line except in the Deccan lava. Beyond this line, owing to logistic difficulties in military expansion, a distinct political domain (*maṇḍala*) operated in earlier ages but this situation has gradually changed since the establishment of the Mughal empire. At no time, however, did any north-south divide exist for the major cultural movements in the country. Vedicism, Buddhism, Jainism, Bhakti, Islam and nationalism recognized no such barrier because 'ideas have wings'.

The validity of this theory of nuclear regions is established by the fact that even the powerful Alexander the Great could not force his way beyond the Beas river in Punjab. It is further validated by the fact that, while the empire of Aśoka the Great extended practically to every nook and corner of the country, the kingdoms of the far south remained autonomous and his empire disintegrated soon after him. These resistant lines remained impenetrable even during the Gupta and post-Gupta, Rajput and Turkish periods.

Spate has rightly stated that the nuclear regions of power, the great lines of advance (geographical lineaments), the refuge areas for the dispossessed, remain unchanged from

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era to era. Historical changes are only political and social, not geographical. Geography, though dynamic in the very long run, takes ages to change, although the significance of geographical factors changes with history.

II. POPULATION AND ITS PROBLEMS

India's population has been growing very rapidly since the demographic watershed of 1921, when medical treatment, sanitary measures, etc. started reducing mortality rates drastically, leading to the concomitant population explosion.

Density of Population

Before independence and before partition, India's population, according to the 1941 Census, was 314.8 million. In 1951, the first census of Independent India, it was 356.8 million. In 1965, according to estimates of the *United Nations Statistical Year Book, 1966*, the Indian Union had more people than Europe excluding the USSR. Doubtless, there was a very large population, but the area of the country being about 3,181,561 sq km, the average density of population was 138 persons per sq km in 1961 and 152 in 1965. This is certainly a high density, but not the highest in the world. It is lower than that of many European countries such as the Netherlands (366), Belgium (310), the UK (224) and Italy (171).

India's population had risen to 842 million in 1991 (almost double that of 1961). Even if the current high level of fertility is drastically reduced by half, India's total population will cross the one billion mark by 2001. Such is the magnitude of the population problems that await India in the coming decade.

In 1961, 82 per cent of the population lived in rural areas, largely on farms and the concentration of population was on good level terrain, rich soil and adequate rainfall or irrigational facilities. The climate of these areas of dense rural population was also favourable for vegetative growth. Fewer people lived in areas where optimum agricultural conditions were absent. The map (Fig. 3) shows India's very uneven distribution of population. A very heavy agglomeration is in the well-watered river basins and coastal plains, and some districts supporting metropolitan and industrial cities. More than half of the country's population lives in one-fifth of the total area. Some districts in the forested hills and plateaus of central India, the mountain areas of the north and east, and the desert areas of the west are among the country's negative areas from the point of the view of human settlement.

The distribution of high densities corresponds to that of the heavy rainfall that produces the major crops. (Compare the map of mean annual rainfall and that of density of population figs. 3 and 4) In 1991, with a mean density of 600 persons to the square kilometer the population of India is increasing irregularly in its distribution. People swarm in the Ganga Valley, which has a greater density than Belgium. It contains 60 per cent of the population of the whole country owing to there being 500 persons to the square kilometre in parts of the valley harvesting three crops a year; between 250 and 500 in parts growing two crops a year; between 100 and 250 in the black earth cotton country; and between 50 and 100 on scrubby uplands and in the mountains. Some districts have particularly great densities, such as those that profit from industry and commerce in addition to the return from agriculture. The district around Delhi contains more than 1000 persons to the square kilometers. The adjacent districts of Bengal and Bangladesh had a still higher density of more than 1700 persons per square kilometre in 1965. This vast concentration of people is explained by the astonishingly small size of field whose cultivation is adequate to feed a whole family in this district.

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NUCLEAR AREAS

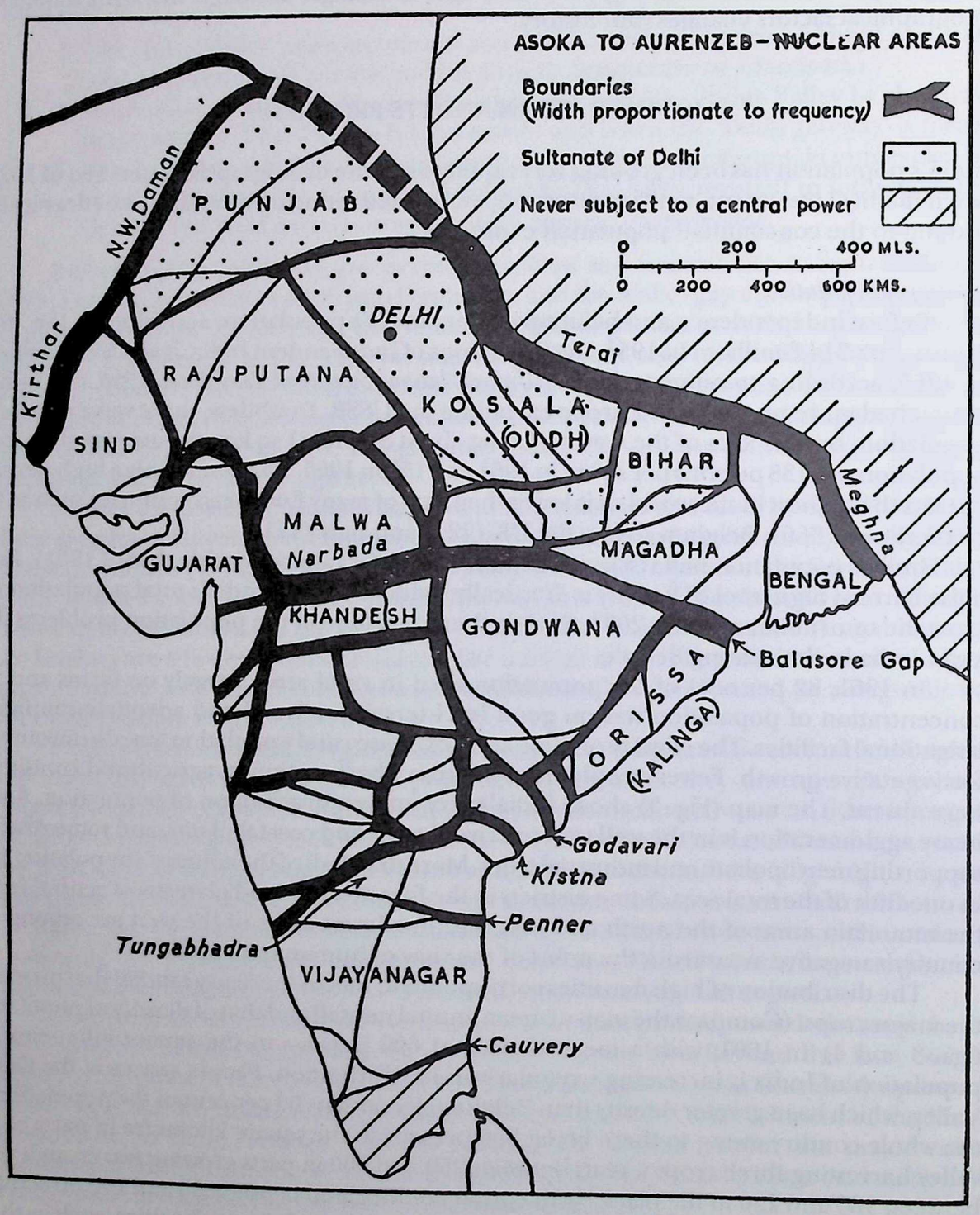

Fig. 2: Nuclear areas by Spate: Ashoka to Aurangzeb, to illustrate the relative permanence of boundaries and persistence of nuclear areas such as Malwa and Gujarat.

Pressure of Agrarian Population

It is rather curious to note that, concurrently with this rate of growth, the geographic redistribution of population is not a dynamic process, as indicated by the following characteristics of India's population:

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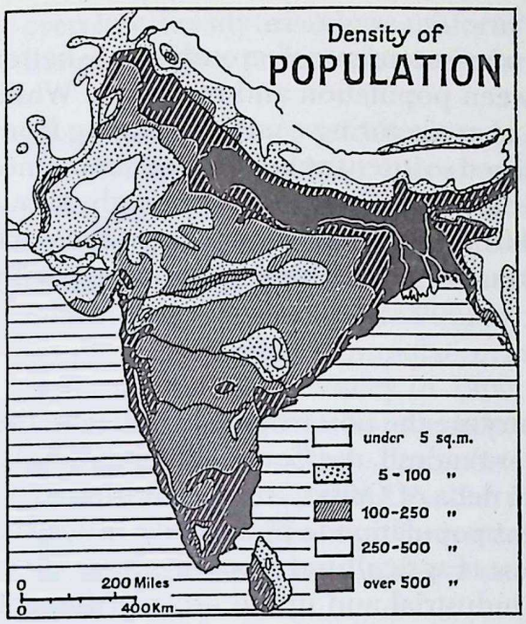

Fig. 3: Population in the Indian subcontinent.

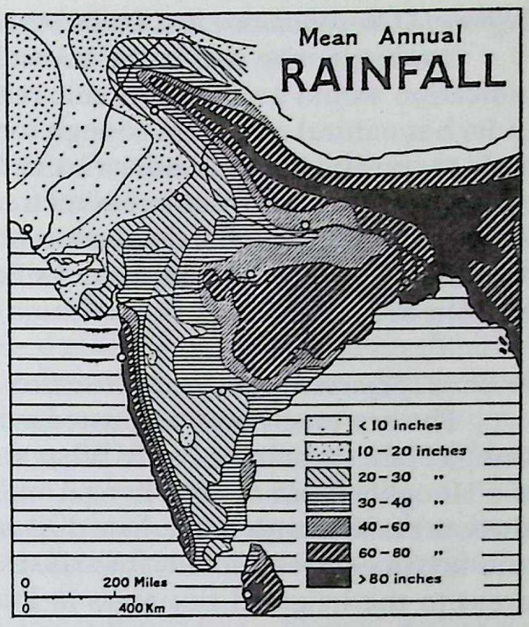

Fig. 4: Rainfall in the Indian subcontinent.

(a) The population is overwhelmingly rural.
(b) The share of urban population increases only slowly.
(c) The average size of population of rural places increase at a faster rate than that of the urban places.
(d) The number of rural places per urban place declines.
(e) There is an excess of cultivators relative to the availability of land resources in the non-irrigated rice areas.

The Malabar cost shows a much higher agricultural efficiency and agricultural density than any other region. Rural crowding in these areas demands immediate disposal of the surplus population to prospective industrial and urban centres.

The hills and mountains in the north and east, though having a very low density of population, also exhibit a very high pressure of agrarian population. Rugged surface, steep slopes, stony soils and inhospitable climate restrict the extent of arable lands, leading to a high agricultural density and a correspondingly low agricultural holding per cultivating household (less than 0.3 ha).

Curiously, the Punjab and Haryana plains, despite their high density of population, show less agrarian population pressure (density 120 persons, holding 5.43 ha). The use of irrigation to overcome the limitation imposed by a sub-humid climate and the progress in industrialization and urbanization have created a degree of balance between agricultural population and land resource in this plain. Contrarily, in Tamil Nadu, despite an increase in extent at cultivated land through irrigation and soil reclamation and the stimulation of migration of rural population from agricultural to non-agricultural occupations, there has been hardly any adjustment between agrarian population and land resource in Tamil Nadu Plains.

The seriousness of problems of population pressure in rural areas resulting largely from natural increase is widely recognized in the country and attempts are being made to make the people aware of the pressing need of fertility control and to persuade them to adopt methods for physiological regulation of fertility. However, there is every indication that the rural areas will be overburdened with too many persons of the reproductive age group (15-59) relative to the size of the land resource, which implies smaller per capita agricultural holdings.

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Degree of Over-population and Under-population

Crude density is not the scientific index for measurement of crowding. A better indication would be the economic relationship between population and resources. While India has natural resources enough for developing a manufacturing complex ranging from basic to consumer goods industries, land has been utilized so intensively from time immemorial that almost every square centimetre of arable land has been brought under plough. About 70 per cent of India's net domestic product is derived from land, and 72 per cent of the work force is engaged in agriculture and allied activities. Other resources have been only partially exploited.

Pressure of Rural Population on Resources

The extremely over-populated parts of the country are the non-irrigated rice areas, the Ganga Plain embracing North Bihar and Eastern Uttar Pradesh, the Coastal Plain of Kerala, the Hooghly Basin of West Bengal and the Mahanadi delta of Orissa. Rural crowding in all these areas demands immediate disposal of the surplus population to prospective industrial and urban centres. Already there is seasonal migration of agricultural labourers from these areas to the irrigated rice areas in Punjab and the industrial and urban areas of Bengal, Maharashtra, Gujarat and south-east Asia. The population is much too large in relation to the land resources in the north-eastern part of the Peninsula plateau due to its thin soil, rich though its mineral potentials are – unparalleled in the rest of the country.

In the southern Peninsula, a large compact area of Telangana Plateau and Karnataka Plateau is also over-populated due to scarcity of water in the wake of unreliable rainfall and occurrences of thin and coarse soils. Some districts of southern Karnataka and north Tamil Nadu suffer from intense scarcity of water for irrigation, of which the long-standing inter-state dispute over the sharing of the Cauvery river waters is a symptom.

The hills and mountains of the north and east, where rugged surface, steep slopes, tough soils and inhospitable climate restrict the extent of cultivable land, can support only a thin population. The same is true of the desert and semi-desert areas which, as a result, are over-populated in relation to extent of cultivable land available. The Indira Gandhi Canal command area has drawn in a large chunk of population from outside the area and has made the Indian desert as most densely populated one in the world. Similarly the Punjab plain the Upper Ganga Plain, and the Krishna-Godavari and Cauvery deltas, are, despite their high density of population, still comparatively, under-populated. However, it is doubtful, with their mainly agricultural potential, whether, even utilizing better techniques of utilization and management, could substantially raise the level of income for their expanding populations.

Plantation agriculture – tea, coffee, rubber, etc. – inflate the value of output and, despite the high density of population, exhibit less of population pressure. But the surplus value accruing from these crops does not bring the labour force any increase in their income above the level of the rural population as a whole, so all the plantation areas are liable to be overpopulated.

To the south of the northern plain, the Chambal Basin, the Bundelkhand Upland, the Malwa Plateau, the Narmada Trough, the Upper Mahanadi Basin, and the low plateau of Maharashtra and Gujarat are some of the under-populated parts in the country. The region of jowar, cotton and sugarcane cultivation is favourable for raising the income of the farmers and achieving self-sufficiency in food production. Some parts of the Karnataka and Raylaseema plateaus manifest under-population consistent with low density.

From the data presented above, it emerges that the areas of very high density (200 per sq km) are not always overpopulated tracts. The areas with excellent irrigation facilities and natural conditions ideal for growing commercial crops like tea, cotton, sugarcane, etc., have proved to be under-populated areas. Paradoxically, thanks to runaway population growth,

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even low-density areas have uniformly to support populations in excess of their capacity and the population pressure is particularly startling in non-irrigated rice growing tracts.

Characteristics of Internal Migration in India

While Indians have a deep emotional attachment to their homelands, nevertheless, some circumstances in the past forced many of them to move from the places of their birth in search of employment opportunities. Such movement was further stimulated by the development of improved transport facilities, and the growth of industries. The massive migration of farmers to the Punjab canal colonies dates back to 1887-88 and Bengal's long-standing congestion of population and scarcity of land pushing the farmers from the Bengal Delta to the Assam Valley in 1900, are examples. One of the greatest magnets drawing populations from their homes in the early years of the twentieth century was the development of plantation agriculture. The main areas from which estate labour was drawn are the Western Ghats in the south west and the North Bengal Plain and Assam Valley in the north-east. Urban centres with significant pull were the metropolises of Calcutta, Bombay and Madras. People from Bihar can be seen in the metropolises of South-East Asian countries, engaged in petty jobs.

The sharp increase in the mobility of Indians over 1951-61 is attributable to:

(i) the development of a strong 'push' factor in the rural areas of the country after independence due to the dearth of arable land and lack of local employment opportunities;
(ii) the increasing gravitational 'pull' of industrial cities and towns;
(iii) the reclamation of arid tracts by the extension of irrigation;
(iv) the rapidly increasing number of construction works related to industrial growth and exploitation of previously, untapped resources;
(v) the launching of rehabilitation programmes for persons displaced from Pakistan; and
(vi) the reorganization of states on a linguistic basis.

Migration is predominantly within states and from rural to rural areas. Rural to urban migration is also significant, but urban to rural and urban to urban migrations are few. With the industrial training of rural populations in the growing number of Industrial Training Institutes (ITIs), rural to urban migration of skilled workers has been increasing.

A noticeable trend of migration since Independence has been that of traders, educated and technical personnel from relatively advanced states to relatively backward adjacent states, for example, people from UP migrated to newly constituted capitals and administrative towns of adjacent states like Madhya Pradesh and Rajasthan. The union territory of Delhi pulled in people from all over the country, particularly from UP, Punjab and Rajasthan – 60 per cent of the migrants being male. Two-thirds of the migrants to Delhi are from rural areas, only one-third from urban areas. The expanding area of the national capital pulled in population from all over the country for service, trade, commerce and construction work. The biggest chunk of migrants came from UP, Punjab and Rajasthan.

Population Resource Regions

P. Sen Gupta and Galina Sdasyuk, in their book *Economic Regionalization of India, Problems and Approaches,* divided India into three population/resource regions, (a) Dynamic, (b) Prospective, and (c) Problematic.

The Deltaic plain of the Ganga, the Deccan Trap, Tamil Nadu, the Punjab plain and the Ganga-Yamuna doab area and the south-eastern Karnataka plateau constitute the *dynamic region* which is expected to pull population from rural to urban areas with the socio-economic

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development of the country. The north-eastern peninsular plateau, the Godavari basin, the Aravali hills and Malwa plateau, the western and southern Karnataka plateau, and the Brahmaputra valley constitute the *prospective region*. In this region are located one or other of the mineralized zones, sites for hydel power, and forest wealth and industrial capabilities. The *problematic region* encompasses the middle Ganga plain, the Orissa and Kerala coasts, offshore islands, and the rest of the country. The problem of overpopulation in the rural areas of the Upper Ganga Plain is due to the denial of central budgets for industrial development during the early Five-Year Plans on the plea that UP was an agricultural state and did not require funds which are earmarked exclusively for development of industrial states like West Bengal and Maharashtra.

III. PEOPLES OF INDIA

The population of the subcontinent exhibits, in varying degree, characteristics of the four major stocks of mankind: Negroid, Australoid, Mongoloid and Caucasoid. The earliest of existing groups are the Negroids, of whom the Andaman Islanders are a good example. They are still hunters and gatherers. The Mundas and Santhals of the south and centre are evidence of Australoid stock. They inhabit areas south of the Narmada-Chhota-Nagpur line. The Veddas of Sri Lanka represent the same stock and are considered pre-Dravidian. The tribals of the north, occupying a broad band of Himalayan and sub-Himalayan country, are of the Mongoloid type. The Assam valley itself has an interesting fusion of Mongoloids with Palaeo-Mediterraneans, the bearers of Hindu culture. There is also an 'Oriental' type, mainly in the northern hills and Punjab, which is intrusive elsewhere with upper-class Muslim descendants of Pathan invaders. In the course of history, there has been much fusion of several types.

In keeping with the diversity of the subcontinent, the entire history of India is thus a complex of several strands. People of various stocks have brought diverse gifts, material and cultural, to the common store. The Vedic hymns and the whole treasury of Sanskrit literature are the most obvious contributions of the Indo-Aryans.

Cultural Diversity

The term cultural pluralism, stands for regional heterogeneity in language, religion, art, customs, etc. India's religious pluralism is rooted in history and is duly recognized in its polity, which it describes as secular. Among the major religious communities in 1981, Hindus accounted for 82.63 per cent of the total population, Muslims 11.36 per cent, Christians 2.43 per cent, Sikhs 1.96 per cent, Buddhists 0.71 per cent, Jains 0.48 per cent, and others 0.42 per cent. Although the Hindus predominate India's demographic scene, yet in six states persons belonging to other religions were in an absolute majority. These states are Jammu and Kashmir (Muslims), Punjab (Sikh), Mizoram, Nagaland and Meghalaya (Christians), and Arunachal Pradesh (Tribals). Most of the states are multi-religious. In fact, all the relatively developed states have a high degree of pluralism – religious, linguistic or regional. The less developed states generally show a greater homogeneity in their demographic composition.

The various communities comprehensively labelled tribes are actually very heterogeneous and very scattered, with two major zones of concentration: the Assam-Myanmar hills and the jungles of Central India. Nagas, Bhils, Gonds and Santhals, are the main tribes. There are many others enumerated in the Indian constitution as Scheduled Tribes and spread in different parts of the country. The Nagas are confined to Nagaland; the Bhils are spread in south Rajasthan, Maharashtra and Madhya Pradesh; the Gonds are based in Gondwanaland; and Santhals are spread over the Bengal-Bihar border. The Hindus are divided into castes, probably some 3000 of them. The extent of plurality in Indian society can well be imagined.

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The Himalayan and Assam tribes speak mainly Tibeto-Burmese languages; those of the central hills speak Dravidian or yet older Austric languages; the south is almost solidly Dravidian; the north is mainly Indo-Aryan.

Next to religion, language is the greatest divisive force in India. Though there are hundreds of languages in India, only sixteen of them are spoken by large numbers of people and these have been recognized in the Indian constitution. Their importance may be gauged from the almost universal demand for formation of linguistic states in 1956 and particularly from the fierce resistance to the decision to combine the Marathi-speaking areas of the Deccan with Gujarat in a single state. This broke down completely, and separate states of Gujarat and Maharashtra had to be formed in 1960.

The 'communities' recognized by the Indian Census, in Indian politics, and in daily life, are primarily religious divisions, although race, language, caste, geographical localization, and broad cultural distinctions also shape them in part. Thus the aboriginal tribes include Hindus, Christian and even Muslims. The great bulk of the population is, of course, Hindu. The partition of the country was based on religion, but even at the time of partition there were 36,000,000 Muslims in India. Three other religions are Buddhism, Sikhism, and Jainism. The first of these spread far and wide in East Asia but had a very limited survival in the land of its birth.

Urban Population

Thirty per cent of the population of India is urban and resides in some 3000 towns of all classes. This is why India is referred to as a land of villages. However, there are certain tracts in which there are more urban centres than in others. Large tracts which are relatively urban include the Hooghly region; parts of the plains of Punjab and western Uttar Pradesh; Rajasthan, especially along the fringes of the Aravali; the Ahemdabad cotton area and Kathiawad with its array of former princely capitals; and southern Malwa for similar reasons. The tract from Bombay to Vadodara is also well urbanized and also several parts of the black cotton soil tract – from Nasik and East Khandesh to Nagpur, from Pune to Solapur, and away to Dharwar and Hubli, and even past the spice towns of the Ghats' crest to the seaport towns from Karwar to Bhatkal. The core of the former princely state of Mysore is well urbanized between Bangalore and Mysore; and so are the core of the Krishna delta area, the Coimbatore and Madurai areas, and densely peopled southern Kerala. Some old towns in very poor or backward areas are stagnant or even actually declining. It may safely be said that urbanization and industrialization usually go hand in hand.

However, despite its description as a land of villages, there is little doubt that India is a more fruitful and hopeful field for urban and industrial expansion than are many other developing countries. What India needs is greater development of small towns and satellite towns around the metropolitan cities in order to arrest the growing chaotic traffic congestion and atmospheric pollution in the larger conglomerations.

Demographic Structure and Trends

The expectancy of life of an Indian baby born in 1901 was 24 years, in 1991 it is 59 years. Death control has been more successful than birth control. Major killers like malaria, cholera and smallpox and other causes of mortality have been subject to control measures.

Unless the reduction in the death rate is followed by an adequate reduction in the birth rate, there is bound to be a serious population problem. After all, even an increase of 1.2 per cent per annum as it was in 1951, represented an annual increase of 4.28 million people – a sufficiently daunting prospect for a nation trying to combat poverty. There are many strands of thinking, sometimes conflicting, about the methods of population planning in India. However, a number of studies of family planning in India have clearly shown that family

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planning is universally accepted by educated couples and, therefore it is rightly held that the entire family planning budget should be directed to education, which would bring better success, than mere appeals.

IV. AGRICULTURE

Indian agriculture is food-crop oriented. About nine-tenths of the net sown area is devoted to food crops and only one-tenth to commercial crops. Agricultural commercialization and a new type of specialization with a bearing on industrial and general development is gradually increasing. Broadly speaking, the types of cultivation in India may be grouped as follows

1. Shifting cultivation (on hillsides)
2. Sedentary peasant agriculture:
   (a) food crops, dry or irrigated
   (b) cash crops, dry or irrigated
   (c) arboriculture or gardening
3. Capitalist farming:
   (a) estates
   (b) plantations

Indian farms usually yield two harvests – the Kharif in October-November and the Rabi in March-April. The former is harvested at the time of the Diwali festival and the latter at the time of the Holi festival. Both are celebrated with their respective products with great enthusiasm and joy by peasant communities.

Food Zones

In India, three groups of states can be distinguished with respect to food grain production:

(1) Granary states which are the main producers, 'suppliers or surplus'.
(2) State which are 'consumers or deficit' and which are constantly importing food from other regions.
(3) States 'between them' – almost 'self-sufficient' in food.

A particular feature of the geography of food grains production in India is that many states that fall under one group with respect to food production and the role they play in the total food balance of the country are situated at extremities, opposite to each other, like the two poles. The old traditional granaries are Uttar Pradesh in the north and Andhra Pradesh in the south; states with the highest level of productivity are Punjab and Haryana on the north-west and Tamil Nadu on the south-east; the chronically food deficit states are Kerala on the south-west and West Bengal on the north-east; and finally the frontier Himalayan states are Assam in the north-east and Jammu and Kashmir on the north-west.

The 'surplus' states geographically alternate with the 'deficit' ones. Thus food zones – extensive areas consisting of a group of states in which demand and supply are relatively balanced due to the fact that 'surplus' and 'deficit' states occur in a proper combination – are formed. For instance, Punjab, Haryana, Rajasthan and the western half of Uttar Pradesh supply food grains to the Himalaya area, Delhi and the western region; Madhya Pradesh, being centrally situated, supplies food grains to the west, as well as to the north-east; Orissa is a rice granary and supplies rice to West Bengal. The main food base of the south is Andhra Pradesh.

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Agricultural Efficiency

Agricultural efficiency is the interplay of a multitude of factors, environmental (climate and soil) and socio-economic (size of holdings, ownership facilities, cropping pattern, crop rotation, etc.). It is reflected in crop yield per acre and total production from a particular unit of area. It hardly needs stressing that the overall agricultural efficiency of India, till the Green Revolution, lagged far behind the rest of the world.

Agricultural Specialization

There are six regions of specialization in Indian agricultural crops, as detailed below:

(1) North-eastern states – West Bengal, Bihar, Assam and Orissa: Rice (mono- culture) is cultivated in the fertile alluvial lower plains and deltas of the Ganga and Mahanadi rivers. Kharif crops do not require irrigation due to monsoon rains from June to September. Rabi crops can be grown only if irrigation facilities are available. Natural calamities like floods are an almost regular feature and swampy marshes and saline soils are characteristic of the coastlands.

Rice is the predominant crop in all these states, and jute is its chief contender in occupying the most fertile and well-drained areas. Tea is an important crop in the upper valley in Assam while sugarcane is an important cash crop in Bihar. Orissa is the only surplus state.

(2) North India – This region comprises the Ganga plain and covers the whole of Uttar Pradesh, which is the major producer of food grains, sugarcane, and contributes nearly 20 per cent of the total output of oil seeds in the country. The depletion of forests in the Himalaya has led to extensive erosion of the alluvial soil. Extensive Terai areas have been reclaimed for sugarcane and other food crops and for jute cultivation. The net area sown constitutes about 60 per cent of the total area of the state. It continues to retain its position as the major sugarcane producer of the country, but its leading role has declined. UP contributes about one-fourth of the total production of potatoes (cultivated in the Himalayan foothills and district Farukhabad). The backward agrarian structure of the state is already at the stage of take off.

(3) The north-western states – Punjab, Haryana, Rajasthan, and Jammu and Kashmir, are situated in a dry sub-tropical zone. Most of this region belongs to the Indus Basin and is arid (Thar desert) and semi arid. This region is the most prospective and has developed rapidly as the granary of India as well as a major centre for animal trading. The net area sown in Punjab and Haryana is above 60 per cent of the total territory of these two states, more than 40 per cent of which is irrigated. Only 40 per cent of the area of Rajasthan is sown. The Indira Gandhi Canal and the Chambal Valley Canal areas are irrigated. Otherwise extensive dry crop farming and stock raising are practised over the greater part of the state while the Thar desert serves as pasture-land for cattle, sheep and camels. Food grains, especially wheat and bajra crops, dominate. Oilseeds are being expanded. In non-irrigated areas the average crop fields are very low. However, during the post-independence period, Rajasthan, previously deficit in food grains, has become a surplus state. Jammu & Kashmir is rich in horticultural produce.

(4) Western India – Maharashtra and Gujarat: These states have a highly commercialized rural economy and well-defined agricultural specialization. It consists of plains and rolling foldings of the Deccan trap covered with heavy black cotton soil or *regur*, in which dry agriculture is pre-eminent. About 50 per cent of the area of these states is cultivable. More semi-arid wastelands are reclaimable in the Kutch peninsula and saline lands at places are inundated by the sea. Millets and cotton are the main products. The area under groundnut is growing making Gujarat the largest producer of this oilseed in India. Tobacco growing has been intensified, producing one-fourth of the country's production. Dairy farming has also developed. The largest milk cooperative, Amul of Gujarat is considered to be a model. 'Suburban' agriculture has thus sprung up all around the big cities.

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There are special districts with developed horticulture: Nagpur (oranges), Thane (bananas) and Ratnagiri (mangoes). There is unlimited scope for the development of marine fishery.

(5) Central India: MP is one of those states on which, to a large extent, the solution of India's food problem is dependent. After Rajasthan, it has the largest land resource. One-third of the territory is covered with forest. It specializes in food grains (rice, wheat and jowar, pulses and oilseeds). About one-fifth of the population is tribal, practising primitive agriculture or shifting cultivation.

(6) South India: All the four states together form the second largest producer of rice after the north-east region. Millets, oilseeds, cotton and tobacco are the other principal crops. This is the only region where black pepper and coffee are grown. It specializes in rubber, tea and banana growing. This is a densely populated region and is intensively cultivated and is the highest consumer of fertilizers. The slogan in Tamil Nadu is 'Not a drop to the sea'.

Kerala specializes in and produces high-value crops such as black pepper, cardamom, other spices, coffee, tea, rubber cashew nuts and coconuts which are exported and is developing the fishing industry.

The agricultural sector still continues to play a pivotal role since it still accounts for about 30 per cent of the gross domestic product (GDP) and almost two-thirds of the population depend on this sector for livelihood. The production of soyabean, oilseeds, edible oils, sugarcane, cotton, jute, plantation crops like tea and natural rubber went up in 1994-95. But the agricultural sector is less attractive for private investment as compared to other areas. The economic survey for 1994-95 suggests that this trend needs to be reversed.

Farm exports provide tremendous resilience to overall foreign exchange earnings as compared to other sectors of the country. Since the import content of agricultural products is insignificant as compared to that of products of the non-agricultural sector, the country's gain is much more per unit of foreign exchange earned through agro-exports. Rice is emerging as a major export product.

Irrigation

With about 75 per cent of the population living in rural areas and about 35 per cent of the national income coming from agriculture, it is rightly emphasized that nothing moves in India unless agriculture moves. And no input for moving agriculture is more important than water.

Irrigation plays a protective role against the uncertainty of the monsoons. Secondly, even with the given technology, mere provision of assured water supply can boost the productivity of the existing inputs. And thirdly, irrigation creates favourable conditions for the introduction of new technology. Fourthly, irrigation provides scope for increasing the net area under cultivation as well as the double cropped area.

The distribution of rainfall in the country is both uneven and uncertain as is the character of the monsoon. Of the total rainfall, 86 per cent occurs during the wet season. It is not only that droughts occur when the rains fail, but even crops in the irrigated areas may also fail when failure of rain in the catchment areas leave the reservoirs empty. This is what happens even in the Indira Gandhi Command Area, once in a while.

India has the oldest irrigation system and the largest irrigated area in the world. Irrigation of some sort has been practiced since time immemorial. The Grand Anicut on the Cauvery, one million cubic feet of masonry, was built in the eleventh century. It is the vagaries of the monsoon that led to this development. By 1967, irrigated area constituted about 20 per cent of the total area sown. Even by 1961 the country was irrigating 336,700 sq km, an area nearly half as large again as the area of Great Britain. The irrigation potential in India has increased from 22.6 million hectare in 1950-51 to 76.36 million hectare in 1989. Commercial

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and food crops are in the process of decentralization, agricultural intensification, specialization and diversification.

The sources of irrigation are canals, wells, tube-wells, tanks and ponds and minor weirs. Irrigation methods vary to suit geo-climatic situations. Canal irrigation is mostly practised in the great plains and the coastal plains while tank irrigation is practised in the Deccan plateau. Tanks and ponds fill up in the rainy season. Hundreds of thousand dug wells are used for irrigation in areas where the ground water table is not very deep. Tube-wells have been developed in areas where electric power is easily available, but diesel pumpsets have also proliferated during the last three decades. In a vast country like India, where crops have been cultivated for ages several indigenous methods are still used for irrigation, and these have been shown to be most scientific from the point of view of water conservation and utilization. It is such methods that have been used in west Rajasthan to collect and utilize the scanty rainfall there.

In Uttar Pradesh in recent times, wells and canals have ceased to be significant as means of irrigation as their utilization is excessively time-consuming and calls for heavy inputs of man and animal power. Farmers have now switched over to pumpsets and tube-wells. Since the eighties, more than half of the irrigation in UP has been contributed by tube-wells. Jointly with canals, they constitute about 90 per cent of the irrigation of the state. There is a high concentration of tube-wells in the Ganga-Yamuna doab. The UP Himalaya and the Southern Upland (Mirzapur and Bundelkhand) are topographically unsuited for intensive development of tube-wells.

Intensity of Irrigation

Within Uttar Pradesh, physiographic, social and economic conditions are responsible for the existing regional imbalances in the intensity of irrigation. In the western part of the state, the intensity of irrigation is above 75 per cent, with a network of canals and a high concentration of tube-wells. The farmers here are very industrious and socio-economically well off. The construction of a large number of multipurpose and irrigation projects have brought about tremendous changes in the condition of agricultural production. The Bhakra-Nangal Project in Punjab, Dandakaranya project in east Madhya Pradesh, Hirakud Dam Project in Orissa, Nagarjun Sagar Project in Andhra Pradesh, Tehri Dam Project in UP, Sardar Sarovar Project in Gujarat, and Indira Gandhi Nahar Project (IGNP) in Rajasthan, are some of such projects which were taken up in various Five Year Plans. They have played their role in transforming the socio-economic and cultural scenario in their respective regions. They have stepped up crop yields about two to five times, particularly in paddy, maize, and wheat. Cropping intensity in UP now ranges from 105.39 per cent in Hamirpur District to 183.57 per cent in Bulandshahar District. The high population pressure districts of Uttar Pradesh are also characterized by high irrigation intensity and high cropping intensity. All this illustrates man's efforts to overcome the physical constraints in agricultural sector in terms of irrigation.

Adverse Effects of Irrigation

The adverse effect of reckless tapping of ground water by tube-wells is seen in the form of lowering ground water levels at an alarming rate. Districts so affected are identified by and classified as 'dark' category districts where new tube-wells are banned. A tube-well extracts water within a radius of 250 metres. Any dug well within this limit is robbed of its water resources. The adverse effect of canal irrigation is seen in areas of over-irrigation. There the water table rises and *ussar* lands are formed, resulting in reduction of yield per acre. This problem is reported from almost all the canal command areas in the country. In the Indira Gandhi Canal Command Area, there is a hard *kankar* pan and a sub-surface gypsum layer which does not allow percolation of water. When the water level starts rising, it creates water

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logging. In the Ganganagar District, where the floodwater of the Ghaggar river got stored in the inter-dunal depressions, it created extensive water logging in the surrounding villages, so much so that some of them had to be evacuated and croplands had to be abandoned. Hence, in such areas, fodder crops are encouraged as they require much less irrigation. Sprinkler irrigation, drip irrigation, and water evaporation control methods are recommended in arid areas. All the indigenous methods of water harvesting, like the *nadies* in western Rajasthan are water management practices.

Improvements in Agricultural Technology

The introduction in 1966 of High-Yielding Varieties (HYV) of wheat seeds form Mexico into Indian agriculture ushered in a new chapter in the production of food grains. Under the various Five Year Plans, several schemes were launched in the country, under the advice of Ford Foundation, for increasing food production.

The 'miracle' wheat seed, requires copious irrigation, massive doses of chemical fertilizers (11 m.t. of NPK was used in 1988-89) and insecticides and pesticides. Another input required for the agricultural revolution is the application of a new agricultural technology. The results were highly satisfactory. The production of wheat in 1965 was about 11 million tonnes, which by 1971 shot up to about 23 million tonnes and by 1991 to about 55 million tonnes. Similarly, the production of rice rose from 42 million tonnes in 1971 to 75 million tonnes in 1991. This kind of development in agricultural productivity is termed the Green Revolution.

It has been observed that the Green Revolution has benefited big farmers while small farmers have been adversely affected. It has also had a far reaching effect in the social landscape of rural areas.

Miraculous Changes in the Thar Desert: The Case of the IGNP Command Area

The construction of the Indira Gandhi Nahar Project (IGNP) is an extraordinary and outstanding example of human endeavor to translate a vision into reality. The IGNP is the largest of the world's big irrigation projects in terms of its size, length, capacity, command area, use of constructional material and human and animal (camels and donkeys) power for the development of agriculture. The project was undertaken in one of the harshest environments in India.

The impact of canal irrigation on the socio-economic life of the people in this arid zone of Rajasthan can be viewed with particular reference to increase in household income, generation of employment opportunities, increase in standard of living, savings and investments in economic terms, changes in occupation and structure and development of community facilities.

After the completion of the project, 15.79 lakh hectares of land will be irrigated in the command area. This would grow some 37 lakh tonnes of agricultural produce annually. Besides drinking water supply to the villages and fodder for livestock, the forest produce would bring revenue in the Rajasthan desert which engulfs about 91 per cent of the famous Thar Desert.

Besides food grains, bumper crops of commercial produce such as oilseeds, sugarcane, cotton, pulses, etc., have been produced. Farms have been developed and cultivation is being done adopting the improved inputs and modern techniques. The canal is changing the whole geographical structure of this region. The once desolate area is now thriving, its big towns and *mandis* buzzing with activity and offering growing possibilities for industrialization.

The project has come as a great boon to the inhabitants of the area. The canal has eased the drinking water problem for both human being and animal populations in the area. To the local inhabitants this is the best asset that has been created in the region. There is now greater

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social mobility and communication among people in the irrigated area. This is reflected in more frequent visits to market places (agricultural *mandis*) and nearby towns and greater exposure to such media as radio, TV newspapers and periodicals.

The project also aimed at dealing with drought on a permanent basis. Schemes of intensive afforestation, and also production of *sewan* grass are being implemented.

The intensity of sandstorms is now lower in the area as a result of irrigation, establishment of agricultural farms and afforestation activities.

Sustainable Agriculture

Sustainable agriculture is an agricultural system that maximizes the benefits from agriculture and minimizes the threats arising from the high inputs of factor like chemical fertilizers in modern agricultural practice. The guiding considerations in the adoption of modern techniques for increasing food production should be:

(1) Whether the long-term stability of agricultural system is being ensured; and
(2) Whether adequate precautions have been taken to prevent long-term degradation of the productive capacity of the biosphere.

To achieve the latter, a pest-control strategy must be adopted, field channels should be constructed, excess water must be drained out, and the crops should be related to the agro-climatic zones for economizing on the use of available water for irrigation.

V. SETTLEMENTS

Settlements as geographical entities are proximate groupings of dwellings and their interrelationships which has, most often, emerged through patterns of development and especially in the rapidly growing cities, in the context of associated socio-economic and regional imbalances. Settlement studies lay special emphasis on the analysis of the demography and economic and social structure of the population.

From the geographical distribution point of view there are three types of settlements – sparse, dispersed, and agglomerated and dense.

In some monsoon lands like Assam, which was peopled at a fairly rapid rate comparatively recently, cultivation underwent great changes. Different stages can be seen from shifting to intensive cultivation. The primitive tribes of cultivators had wide areas of land at their disposal and could leave land fallow for long periods after each successive movement of a village following the exhaustion of the soil of the surrounding area. But when population increased, the available land became scarce and village-removal more difficult. The difficulties were increased by a long period of warfare. Today, there are still tribes that continue to practise the same system of cultivation in the poorest and least populated parts of Assam, but elsewhere the villages have become permanent. The last stage in the permanent establishment of the cultivation of the land is marked by the development of rice cultivation. It entails the tying up of manpower to the fields, and the complexity and amount of work which it involves makes rice cultivators most reluctant to leave land they have fashioned. Rice cultivation, which is the final stage in the development, is also the cement that holds village communities together in India, as elsewhere in the south, south-east and east Asia.

Form and Development of Compact Settlements

Historical data agree in showing that when agricultural communities have settled firmly on the soil, they have done so by preference and, in most cases, in the form of compact settlements. Prehistoric man was incapable of struggling against nature by himself. Even when

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it is merely clearing land by fire, he has to act in cooperation with others. At first sight, the compactor of a settlement seems to be a factor common to all primitive peoples. Neolithic remains always reveal large agglomerations of huts.

The needs of security and common defence were not the only causes of nucleation. The position of Neolithic villages was often determined by the situation of land that was fertile and easy to work. Then preference was for lighter soils. Even among primitive people with no knowledge of agriculture the form of compact settlement is most common. The tribals in Assam make common dormitories for bachelors and maidens in compact settlements. Compact villages are of different shape and size according to the nature and resources of the surrounding country: when the resources are poor and scanty, the villages are small. At the desert border in Rajasthan the villages are very small, with few huts (called *dhandis*).

Intensive cultivation has given rise to the greatest number of very large villages. Wherever an organized permanent system of cultivation prevails, the existence of compact villages bears this out. Big villages are in fact traditional in India: 85 per cent of the population still live in thousands of such villages.

However, if once a compact settlement is formed, human and social factors suffice to endow it with extraordinary powers of resistance, which enable it to survive the disappearance of the economic and technical reasons which give rise to its foundation. Indeed, the village is the focus of social crystallization. Common interests, and often common sentiments, unite villagers from generation to generation. The most humble of these institutions is the village *chopal*, temple, well, *dharmashala* and *panchayat griha*. The village market is also common or communal property.

When every one of the villages can contain within itself a certain number of crafts, their economic foundations are much sounder and the compact form of the village is greatly strengthened. Such villages, combining agriculture with rural industries, were common in the sixteenth to eighteenth centuries, till this integration began breaking down increasingly.

Dispersed Settlements

The traditional structure cracked with socio-economic and cultural development. The abolition of the zamindari system and the Land Consolidation Act have led to a breaking up of the community and the rearrangement of land holdings has taken many forms. At some places compact villages have been destroyed, and farms have been rebuilt in isolation, each on its own land. Also, through the growth of plantation agriculture and extensive cash cropping more dispersed settlements have come into being. These types of settlements are also the creation of large irrigation schemes like the Indira Gandhi Canal, where a minimum of 100 hectares of land is allotted to a household and people start living on the farms.

The initiative was not always taken by the villagers; the forms were often imposed by an authority alien to the countryside, and in some districts this ended in an artificial and wholesale rearrangement of the land and the settlement pattern. Under the new arrangement of fields, the scattered parcels of land became reunited into compact areas, the farmhouses were built each at the centre of its property. This happened in the Chambal Valley development tract in Bundi District where the water logging problem in the black cotton soil had cropped up as a result of canal irrigation, rendering the land unfit for cultivation. The scheme of 'On-farm Development' resulted in the redistribution of compact farms.

In conclusion, it seems that compact settlement is always due to some constraints; physical, when man is ill-equipped to deal with his environment and must needs form a group to succeed; technical, when the equipment demands a set course in the use of the soil. There is also sometimes a social constraint imposed by the landowner, or a rigid social structure.

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The development from compactness to dispersion which is very general, and today is still visible, is not irreversible. In most of India, the rural population has increased while the number of villages has decreased. This reflects the transition of settlements from rural to urban. Half of the total urban population is concentrated in class I cities and the proportion of total urban cities of lower classes declines with the lowering of class size.

Socio-economic development during the past several decades have transformed the integration of space economy, i.e. the specialization and differentiation between the settlements in the interior of the country and the major ports has increased. Hence, the two-way traffic and two-way trade flow has been augmenting the economy of the settlements in the interior.

Rural House Types

A geographical study of Indian house types is vast in scope and rich in instruction; a few of the more striking features are traditional rather than environmental. Not only the site and layout of the house, but the geography of the house often reflects age-old religious and magical traditions. The round huts of some lower castes in Telangana, with bold vertical stripes of white and rusty red, for example are clearly cultural rather than geographically influenced. At the other extreme from the rude massive huts of Bundelkhand we have the elaborate courtyard house of the richer Uttar Pradesh farmer, with some pretensions to elegance – the survival of decayed traditions – in doorways and arcading. Some Indian domestic building indeed reaches a high standard of artistry. Environmental influence is well seen in the flat-roofed blank-walled box standard in Punjab and western Uttar Pradesh, so strongly reminiscent of arid west Rajasthan. Flat roofs are used for sleeping on during the summer. But with the growing insecurity and the use of coolers, sleeping on house roofs is disappearing and people mostly sleep inside their houses. The rise in the economy of the rural people is discernible in the better form and upkeep of rural houses as seen while travelling by train.

Indian Towns and Cities

Town or *kasba* is an inhabited place larger than a village and a larger town is called a city. The people living in towns and cities are referred to as urban populations. But the main difference between urban and rural centres is one of function. Thus, town and city have urban or non-agricultural functions. However, Indian towns may have as much as 30 per cent population engaged in agricultural activities. The Census of India does not make any difference between a city and a town but classifies them on the basis of population size and these size categories have been changed at times and thus their reported number and size of urban population has also been changing.

The great majority of census towns still have very strong agricultural elements within them. One may find large numbers of dairy cows and buffaloes rallying in and out for grazing. Most of the towns are administrative, like tehsil or district headquarters, but all of them have markets and commercial functions. They also have a large number of rural people commuting daily from the villages. For large cities, cheap and regular transport services, rail and road, are provided by the government. In most Indian towns and cities the residential and commercial establishments and traders still live over their shops and offices; poor artisans making articles of daily need, live and work in tiny shops located in minor streets and bazaars.

In Indian cities some streets specializing in certain commodities are called *saraf* and *bajaja*. Sometimes members of each religion, community, caste or race live close together. These areas are also named accordingly. For example, a colony or mohalla where Brahmins reside is called a Brahmapuri. The cantonment, the mall, and civil lines in India are expressions of British culture.

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Since independence, town planning departments of the state and central governments have developed new residential colonies with community centres and neighbourhoods almost everywhere in cities, towns and big villages for the accommodation of exploding populations. Housing boards have provided residential plots and houses to hundreds and thousands of people and still a large chunk of population do not possess houses or even get one on rent. The traditional science of *Vāstu,* however, has been totally neglected.

The creation and utilization of varied types of building materials, and the development of architectural designs and engineering techniques within the last several decades has brought about magnificent and beautiful residential premises, multi-storeyed commercial establishments, arcades and public places in Indian cities. Simultaneously, the number and size of urban slums and squalor have also increased almost everywhere. The traffic congestion in cities has already become chaotic and has degraded the urban environment. Delhi is acquiring the dubious distinction of being one of the world's noisiest cities. The multiplying number of vehicles in Delhi is not only polluting the air but shaking its residents' peace and quiet. Even the hill-stations and pilgrimage towns have not been spared from this type of degradation.

VI. THE EVOLUTION OF INDUSTRY

Rise of the Industrial Mode of Life

Very few people know the history of the giant Tata Iron and Steel Company (TISCO) at Jamshedpur as the blessing of Indian Steelcraft displayed in an international exhibition held in Germany in 1896. Jamshedji Nausherwanji Tata, on a visit to the exhibition, happened to see an excellent steel sword with a mark 'Made from Indian Steel'. Tata immediately returned to India and planned to search for high grade iron-ore for setting up a steel plant in India. Now Tata's is one of the largest enterprises in the world. During the earlier centuries, when sailing ships, water-mills and handlooms were the most complicated machines in existence, India shared with China and Byzantium, the leadership of the world in technical ingenuity, economic organization and volume of manufactures. Few finer textiles can ever have been produced than the 'woven wind', the diaphanous muslin of Dacca, and wrought iron pillar at Delhi, dated at latest AD 415, would rank as an outstanding technical achievement. For about 150 years after 1600, Indian textiles were a main staple of eastern trade, capturing western markets from local producers.

Village Crafts

The first stage in the development of the industrial mode of life is household and village industry. Members of the family are both workers and consumers. Several crafts had already emerged from the family circle to operate in specialized workshops. Village economy belongs to the same type of industry, for it is restricted to a closed circle and is a mere extension of family economy. It is still to be found in big villages in India. Alongwith the development of manufacturing, the tendency towards the development of crafts was encouraged by the cult of swadeshi which still persists. This has paid dividends in the shape of exports to great European and American dollar markets of handicraft goods produced in our villages. A potent reason for this change is that, by and large, traditional handicrafts and small rural industry remain significant in the more backward and inaccessible areas of the country which have now been connected with a wide range of means of transport. Gandhi had rightly propagated the development of village crafts to provide massive employment in the villages so as to discourage villagers migrating to urban squalor in search of employment.

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Development of Manufacturing Industry

Even during the British regime the Indian National Congress, which was fighting for independence, had prepared plans for the economic development of the country. K.T. Shah, a renowned economist was the author of *National Plans* based on the Gandhian principles of the party. However, after four years of independence and the constitution of the Indian Union as a Republic in 1951, the government turned towards promoting a socialistic pattern of society, with a mixed economy as between the public sector and the private sector. The series of Five Year Plans were aimed at speeding up and directing the rapid economic development, and especially the industrialization of the whole country and its federal states. Paramount importance was given to the geographical location of industries.

What principal manufacturing areas the nation inherited from colonial rule in 1951 are shown in the map (Fig. 5). Most of these nascent areas were characterized by a sprinkling of industrial foci in rural tracts otherwise relatively little affected by urbanization or industrialization. The major regions were, (a) the Bihar-Bengal Industrial Belt, (b) the Bombay-Poona region, (c) the Ahmedabad-Baroda area, and (d) the Madurai-Coimbatore-Bangalore grouping.

Since food is of primary importance, the first Five Year Plan was mainly oriented to agriculture. The establishment of the fertilizer plant at Sindri (Bihar) is of this period. Its locational factor was the availability of power in the north-eastern zone and the market in the north Bihar and Bengal plains. Its raw material (gypsum) was hauled from Bikaner (Rajasthan) with a transshipment from metre-gauge to broad-gauge at Yamuna Bridge (near Agra Fort). Years later, it adopted a petrochemical raw material base.

The Second Plan (1956-61), without neglecting agriculture, emphasized more on industrialization especially on heavy industry. It was necessary to provide agricultural and engineering machinery and power generating plants.

During the colonial period about three-fourths of the country's factories were concentrated in the three major ports of Calcutta, Bombay and Madras. These main industrial-cum-port centres gave an impetus to the economic development of adjoining areas which, by level of economic development, far surpassed all other parts of the country. It was in these centres that the bulk of non-agricultural export goods as well as industrial products meant for internal consumption were manufactured.

The total output of the jute industry (concentrated entirely in Calcutta and its suburbs), almost the entire output of coal and iron ore mining industry, as well as four-fifths of India's tea output were produced in the North-East Region comprising Bengal, Bihar, Orissa and Assam, with Calcutta as the centre. The first Ferro-metal works were also established in this region. TISCO is the blessing of the First World War during which there was an abrupt fall in imports from the warring countries and a boom in demand for Indian industry. In the western region (Maharashtra and Gujarat), with Bombay as the main centre, was concentrated about two-thirds of India's cotton textile production, then the second-largest in the world. Approximately a quarter of the vanaspati industry was also located in the western region. The southern region, (all the four present states), with Madras as the centre was not as industrially significant as the western region, yet it was here that a greater part of the rest of Indian cotton textiles and tea were produced. More than two-thirds of India's total output of hides and leather and 40 per cent of its vanaspati were produced here.

These three most developed areas exhibited important features characterizing economic regions, particularly district specialization, bearing a national significance. Transport and economic links were unilateral and export oriented. The main branches of the economy were restricted to the supply of raw materials from the hinterland to industries concentrated in the major ports. As a result, within these regions also, complete production cycles were lacking. The rest of the country was characterized by an extremely low level of economic

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development. Of course the Indo-Gangetic basin, the major agricultural zone in India, with centres of sugar, rice milling, cotton, leather and footwear, and glass industries, continues as such, first due to the natural environment, then thanks to the policies of the Government.

Iron and Steel Industry

The world's richest deposits of high-grade hematite iron ore in the Chhota Nagpur plateau and coking coal deposits being concentrated in the Damodar basin, the first iron and steel factories in India were established in the early twentieth century by TISCO at Jamshedpur and Indian Iron and Steel Company (IISCO) at Asansol. By the time of independence their summary capacity was about one million tons. The Durgapur and Rourkela plants, built with British and German assistance respectively, came up in the same region, each with one million tonne capacity. Under the Government of India policy of decentralization of the metallurgical industry, another one-million tonne steel plant, based on Rajhara iron ore, was established at Bhilai with Russian assistance. Since coking coal is brought here from the Raniganj-Jharia coal fields, at a distance of 750 km from Bhilai, the returning empty wagons carry iron ore to Jharia where another one million tonne steel plant was established at Bokaro Steel City. However, among all the plants, the lowest per tonne manufacturing cost has been achieved by the private sector TISCO plant at Jamshedpur.

Further decentralization is impeded by the absence of coking coal outside the Damodar Valley. The only steel plant based on charcoal (available from the dense forests in the Syadari hills) is at Bhadravati (Karnataka). It produces special steels and ferrous alloys (tool steels).

Modern progress in metallurgy is gradually diminishing the necessity of locating iron and steel plants near coal fields. Hence, the development of the steel industry in the south (Marmagao, Hospet, Salem and Vishakhapatanam) has significance in changing the pattern of location of metallurgical industries in India.

Engineering

The development on iron and steel works resulted in crowding of most engineering enterprises in Calcutta, Bombay and Madras, the main port-cum-industrial cities. The motto of the Third Five Year Plan was, 'Build machines; Build India'. Today, India is self-sufficient in the production of machinery for the sugar, tea, jute, and cement industries. With the establishment in the public sector of the Chittaranjan Locomotive Works and the Perambur Integral Coach Factory, import of rolling stock was stopped, but the demand for goods wagons has been steeply rising and is now beyond the capacity of the Perambur factory.

In India, special significance is attributed to the location of machine-building projects for resolving the problem of uniform distribution of productive forces and the economic uplift of backward areas. Thus, the Third Five Year Plan proclaimed the goal of one machine-building plant in each state. To encourage decentralization in industries, the Government of India has fixed a uniform price of steel at all the railway heads in the country since 1956.

Thus, while Calcutta (machinery for the jute and tea industry), Bombay (cotton textile equipment) and Madras (sugar, paper, chemical plants) continue to be the leading machine-building centres, towns in their neighbourhood have rapidly emerged as manufacturing sites, and as centres of specialized education and research.

Some other centres of light engineering industry are gradually expanding into machine-building. Examples are Coimbatore (the cotton city) in the south, Ahmedabad and Baroda in the west, and Durgapur and Ranchi in the east. Major machine-building plants have gravitated to the Damodar basin (Chittaranjan Locomotive Works and Tatas at Jamshedpur). The Tata Consortium manufactures a host of industrial equipment. Bangalore has become the biggest machine-building centre in the south for Hindustan Aeronautics Ltd. (HAL), Hindustan Machine Tools (HMT), Telephone, etc. and is now emerging as the 'Silicon Valley'

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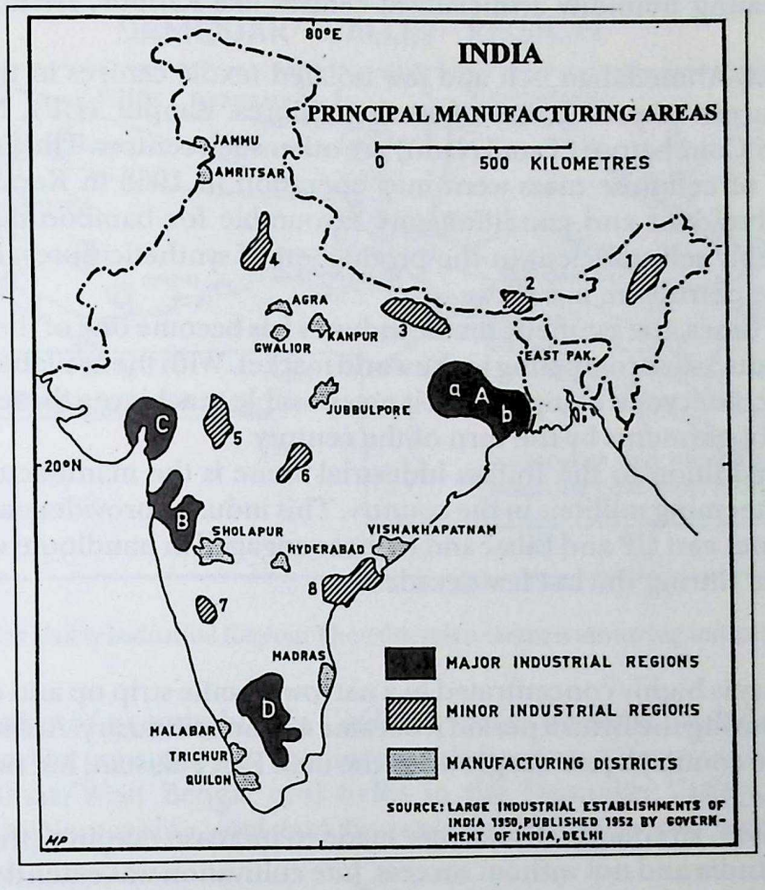

Fig. 5: Most of these nascent industrial areas of 1950 were (and are) characterized by a sprinkling of industrial foci in rural tracts otherwise relatively little affected by urbanization or industrialization.

of India. Heavy electrical plants have come up at Bhopal, Rishikesh and Hyderabad, each with some foreign assistance. Within an approximate radius of 200 km from Delhi, extensive industrialization has been taking place within the so-called National Capital Region, extending into Haryana, Punjab, UP and Rajasthan. It is herein that hundreds of thousand Maruti cars and vans are turned out annually.

Chemical Industry

Chemicals are one of the rapidly developing industrial sectors in modern India. Availability of a variety of raw materials and industrial wastes and by-products, and also low quality coal used in the chemical industry has offered vast opportunities which have been seized by Indian industrialists to set up a fertilizer plant for each state. Petrochemical units have been set up in the Bombay-Ahmedabad belt; fertilizer factories at Rourkela, Durgapur and Bhilai steel plants, and at the Zawar Zinc Smelter plant in Udaipur.

Cotton Textiles

Cotton textiles, the first of India's modern industries, retains its premier position. Combined with handloom production, it stands at first place in the world. Its early location at Bombay was the result of the simplest of geographical factors – a humid climate, a cotton growing hinterland, a major port with modes of transportation of yarn, exports to China, import of bulky machinery from England and coal from South Africa. After the introduction of the industry at Calcutta and Bombay, the cotton textile industry grew also at interior

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locations by creating humidity artificially at centres like Kanpur, Delhi, Coimbatore, and Ahmedabad.

The Bombay-Ahmedabad belt and few isolated textile centres in the south have now become major areas of production of synthetic fibres. Kanpur (UP), Nagda (MP), Kota (Rajasthan), and Coimbatore (Tamil Nadu) are other such centres. The first Indian plant for the production of cellulose mass went into operation in 1963 in Kerala, where bamboo resources are abundant and conditions are favourable for bamboo cultivation, India at present is probably self-sufficient in the production of synthetic fibres, especially with the expansion of the petroleum industry.

In modern times, the synthetic textile industry has become one of the most advanced in India and its products are competing in the world market. With the available large design skills and modern machinery and equipment, it is now possible to achieve a three million US dollars mark in export of garments by the turn of the century.

The latest addition to the Indian industrial scene is the manufacture of ready-made clothing for the teeming millions in the country. This industry provides employment to poor people drawn from east UP and Bihar and to those engaged in handloom weaving, which has greatly expanded during the last few decades.

Jute Textiles

This industry is highly concentrated in a narrow 60-mile strip up and down the Hooghly from Calcutta. During the British period it became a famous industry. At the time of partition, 80 per cent of the country's jute was grown in the then East Pakistan, but not a single jute mill was located there.

After partition, strenuous efforts were made to increase raw jute (the so called golden fiber) output in India and not without success. Jute cultivation was extended in Assam, in the delta areas on the eastern coast and in Terai belt of Uttar Pradesh. However, the quality of the output was not comparable to that of Bangladeshi jute, some of which was imported against the supply of coal, in which Bangladesh is deficient. Without much delay, Bangladesh was able to establish its own jute mills.

Cement

The locational trend of this industry has been shaped by a quite unique combination of circumstances. The Vindhyan system of mountains, including the Kaimur, Rajmahal and other ranges, running eastwards from Rajasthan up to south Bihar, contains some of the finest deposits of limestone and other building materials in India. The best coal fields of India lie in the states of Bihar and Bengal. To the north of the Vindhyan system, gypsum is found in Rajasthan in the Bikaner-Nagaur region. Thus, a belt running from southern Rajasthan through northern Madhya Pradesh up to south Bihar contains numerous excellent sites for the establishment of cement factories. India's production capacity is expected to rise to a billion tonnes per year.

VII. SOME TRENDS IN THE LOCATION OF POWER GRIDS

Energy supply and all sectors of a national economy are closely and inextricably linked. Adequate energy supply is a powerful factor in determining the location and development of industries, particularly of the energy-intensive ones. The significance of commercial energy from coal, oil and hydroelectricity is continuously increasing.

India's coal resources are adequate to meet potential demands for a long time to come but are deficient in quality – limited resources of coking coal, very high ash content – and are

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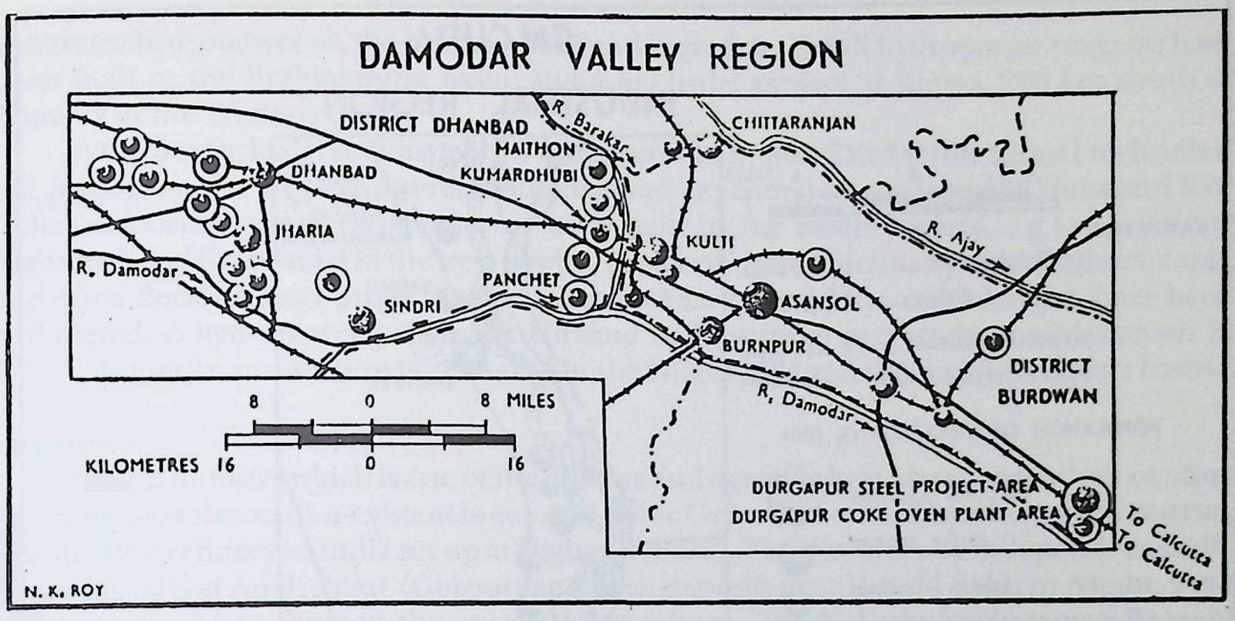

Fig.6: Damodar Valley Industrial Region: The minerals resources attracting industrial centres.

very unevenly distributed geographically. Coal has, therefore, to be hauled over distances of as much as 1500 km for consumption in some establishments. All sources of coking coal are situated in the Bihar/West Bengal coal fields in the Damodar Valley (Jharia, Bokaro, Raniganj, Giridih). Non-coking coal may be replaced by the by-products of coking coal washeries.

Thermal Power

In pre-independence India, locations of electric power stations were mainly demand oriented. Thus about half of India's thermal power was generated in Calcutta and its surrounding area; about 60 per cent of hydropower at three stations on the Upper Krishna supplying Bombay city with power. Since independence, a number of thermal plants were erected at the Damodar Coal Basin, others mostly in Central India, and some in the south. Besides these, the existing thermal power stations at Calcutta, Madras and Delhi were expanded. Earlier in the century, thermal electric power in Bombay used to be generated from coal imported from South Africa as shipment was cheaper than rail haul. In Central India, in addition to the Bhilai thermal plant, a thermal station at Korba on the local coal field has become one of the largest electric power projects in India under the National Thermal Power Corporation (NTPC). Here Durg-Bhilai town has grown into a large industrial centre with fast growth and a bright future.

Hydropower

Power stations operating on natural gas and petroleum were built in crude oil producing and refining centres. Under Indian conditions, hydropower stations have certain specific advantages over thermal power stations. Many of these plants are constituents of multipurpose projects. From a geographical point of view, there is a uniform distribution of hydropower resources, forming concentrations in the mountainous areas. The economically utilizable hydropower potential has been estimated at about 41 million KW at 60 per cent load factor.

In Uttar Pradesh, where mini hydropower plants were first constructed at small waterfalls on the Upper Ganga Canal, an integrated power grid system has been developed through

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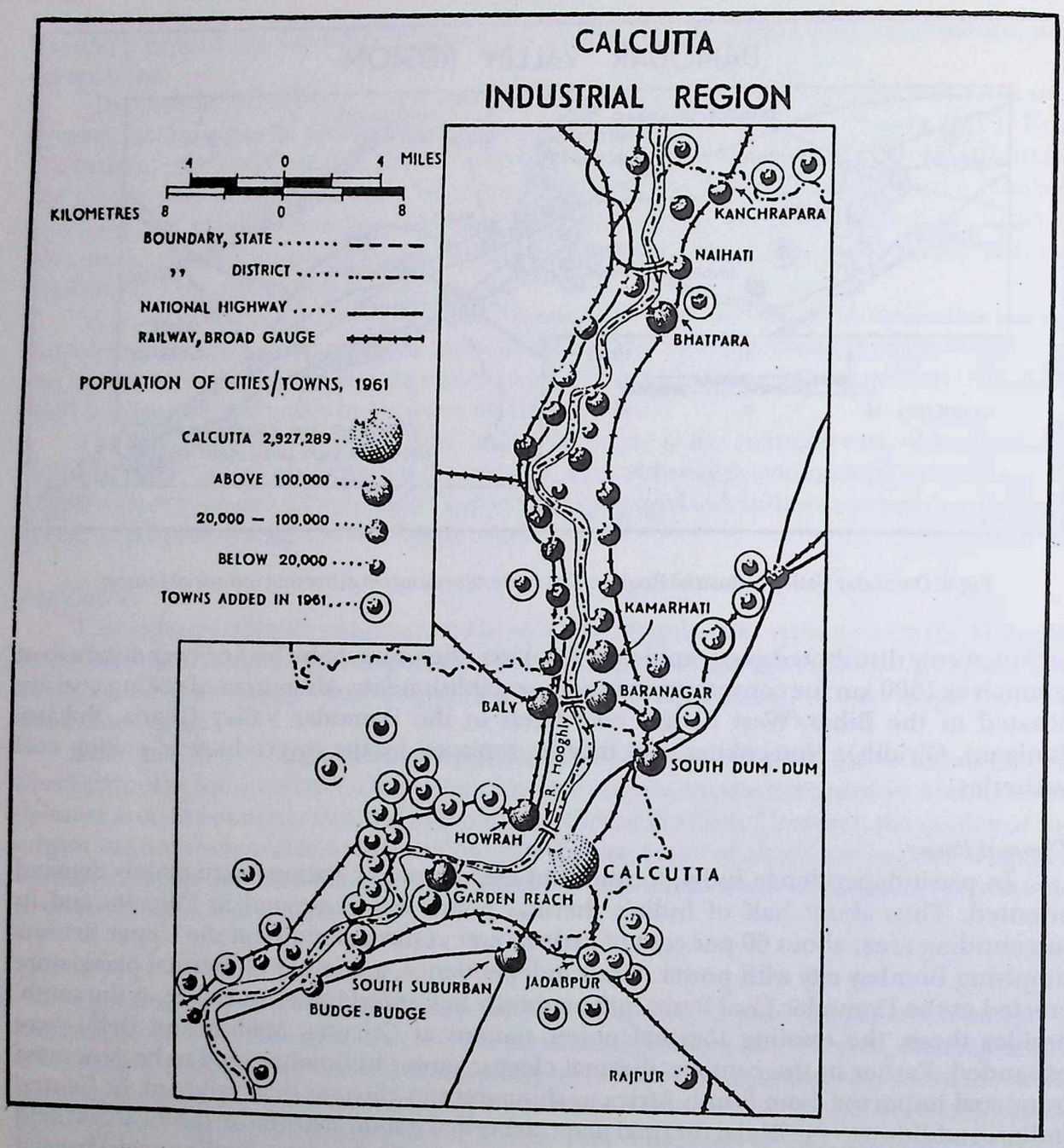

Fig. 7: Hooghly Banks: Concentrating industrial centres in a 60 km-long narrow belt.

interconnection of the energy poles of Rihand and Sigrauli on the south-east with the Yamuna and Ramganga hydel projects on the north-west. The Yamuna Valley Hydel Project at Kalsi is a technological wonder of the modern world. The major transmission lines pass through the major cities of the state in which at present only local thermal stations are in operation. In this way the regional power grid system is expanding in north India.

The largest hydel-electric project in India is the Bhakra Nangal on the Sutlej river with an installed capacity of 1,160,000 kW. On the Beas river, a still larger project is under completion. In the Ganga Basin, hydroelectric projects located mainly on the tributaries have maximum economic significance. The Damodar Valley Corporation's (DVC) multipurpose projects are in the north-east region. It was planned on the lines of the Tennessee Valley Authority (TVA) of the USA. The Chambal valley multipurpose project in the north-west

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generates hydropower on the border of MP and Rajasthan. Small hydropower projects have been built in the Brahmaputra basin, and a big hydel project at Koyna, 200 km south of Bombay in the Western Ghats.

In the South, hydel stations are the only source of power. The Mettur tunnel hydroelectric project on the Cauvery was reconstructed and expanded to produce 250 thousand kW. Other important power projects have been built in the western parts, e.g. at Srisalem, Mahanadi and Godavari. On the west-flowing southern rivers which are generally short, rapid and often flooded, large projects such as those at Sharavally, Iddiki and Sabargiri, have been completed. A hydropower pole is the Hirakud multipurpose project on the Mahanadi in Orissa. Intensive production is emerging in the Nilgiri hills and the north Godavari basin.

Petroleum

The oil industry which is one of the decisive and dynamic branches of twentieth century economy, was almost non-existent in colonial India. Only at the end of the nineteenth century was the first refinery in India set up at Digboi (Assam). The discovery by independent India of oil deposits at Ankleshwar (Gujarat) and fresh deposits near the old fields in Assam, were great events. Then opened the epic of oil pipelines. The Naharkatia-Nunamati-Barauni pipelines (1150 km) move crude oil from the Upper Brahmaputra Valley to these refineries. Since the Assam oil supply is not sufficient for the Barauni refinery, a 530 km pipeline was laid from Haldia, a new port near Calcutta to carry imported crude oil from there to Barauni. Pipelines have also been laid to supply petroleum from Barauni to Calcutta and to Kanpur. At Haldia, a vast public sector refinery is coming up to meet the fast-growing petroleum demands in the north-eastern region.

Important petrochemical complexes have been developed in south Gujarat and Mumbai based on crude from the Ankleshwar oil fields. The refinery at Koyali near Baroda receives its crude from Ankleshwar via a 98 km pipeline. A 120 km product pipeline between Koyali and Ahmedabad and a network of short gas lines in Gujarat are sources of great strength in a state deprived of coal resources and having any hydropower potential of significance.

By 1971 the output of crude oil in India had reached 10 million tonnes while the demand was 22 million tonnes, the deficit being met from imports. Hence, new refineries came up at Cochi (Kerala) and at Chennai which serve their large respective hinterlands.

Atomic Power

Atomic power plants at Tarapur, 150 Km north of Mumbai, at Ranapratap Sagar in Rajasthan, Kalapakkam in Madras and at Narora near Aligarh in Uttar Pradesh, are geographically well distributed. The high tension transmission lines linking these power stations with their consuming areas form the skeleton for the growing regional power grid system which strengthens the economic integration of territories.

The generation of these power-grid complexes all over the country not only helped in the integration and dispersal of industrial complexes but also attracted a number of energy-intensive industrial units, such as the largest nitrogenous fertilizer project plant at Nangal, caustic soda and chlorine plants in many places, and aluminum smelters at many sites close to bauxite mines.

VIII. TRANSPORT

Transport is the most widely pervasive service within the economy as it delivers products to consumers, and thus establishes links between the two. During the colonial period the expansion of the railways (commenced in 1853) was guided by administrative and military

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considerations. In the beginning, the main railway lines were laid from the major ports to the interior parts of the country, but interlinks between the latter remained weak.

Railways

Since, in the early period, different private companies laid their own lines, different gauges were adopted. A majority of the princely states were served by metre and narrow gauge lines. The colonial rulers structured the railway rates at levels advantageous for traffic to and from the ports, making moving of goods for export of Indian raw materials and import of foreign manufactured goods to the interior consuming centres cheap. The North Western Railway was constructed during the colonial period to transport large quantities of wheat, a crop introduced in the Canal Colony of Punjab during British rule to the Karachi port for shipment to Britain. The British interest in railway construction was due to military considerations also. Many lines were also laid along the rivers with a view to suppressing the indigenous river traffic.

On the advent of independence, the national government realized that backward areas cannot be uplifted and their resources exploited until a proper transport system emerges. The demand for transport has risen at a substantially faster rate than the growth of production in any major sector of the economy. To meet this increasing demands, all the metre gauge lines are being converted to broad gauge, a process which will be completed before the end of the century.

Indian Railways, the second largest railway system in the world, operates nearly 78,000 passenger services a day to move about 11,000,000 people over a route length of approximately 62,300 km. For administrative convenience, the system is divided into nine zones. Six more zones are operational from July 1997. From the viewpoint of employment, it is the largest industrial enterprise in the world, yet this network is unable fully to meet the requirements of economic growth. Electrification and dieselization have not yet been universally achieved, to say nothing about total conversion to double tracks. A long needed railway track along the Konkan coast in the west is now under completion. Plans to carry the railways to Kashmir and the north-eastern hill states are being envisaged inspite of tremendous physical hurdles. There has been a veritable revolution in goods traffic.

Roads

'Roads sow the seeds of development, and development creates new roads' is a well known axiom. The nation needs a new technology of excellent road building. Since independence increased attention is being paid to their development. The Nagpur Road Congress in 1943 prepared a National Road Plan, still the basic document in the field. It envisages that, in each highly developed agricultural area, no village should be more than two miles from 'a road', not more than five miles from a 'main road'. Similarly, in a non-agricultural area, no village should be more than five miles from 'a road' and not more than twenty miles from a 'main road'. By 1960, the target of road mileage envisaged in the Nagpur plan was realized. The Nagpur Road Congress had rightly stated, 'you pay the cost if you build roads, you pay more if you do not build them'. The latest Road Congress has recommended the proliferation of bridge building for which already a National Bridge Corporation has been set up.

If one glances at a map of India's road and rail network, one would find the densest network is over the Indo-Gangetic plain which has a topography favourable to their construction and expansion. This becomes expensive and problematic in different terrain. The development of roads and conversion to broad gauge railway tracks in the border districts has obvious strategic implications.

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Inland Water Transport

Out of a total river length of 42,000 km and of canals of 25,000 km the length of transport routes operated on them is only 13,500 km. The summary volume of the goods traffic handled by 20 intermediate and 150 minor seaports adds up to only about eight million tonnes. Besides the three major seaports, Bombay, Calcutta and Madras, seven other major ports are Mangalore, Marmagao, Vishakhapatanam, Cochin, Kandla, Haldia and the latest one, Nhava Sheva. Pipelines have been specially laid for transporting liquid fossil fuels.

IX. ECONOMIC REGIONS FOR PLANNING PURPOSES

Natural regions and economic regions though closely interlinked are not identical. The former evolve as a result of palaeographic evolution of the landscape; the latter evolve through human efforts to meet the economic needs of society. An economic region is an essential frame for reconstruction of the economy of an underdeveloped country. In a country like India, where resources are developed essentially in an agricultural setting, the grouping of states having a common river basin seems to be the most scientific approach to the delineation of planning regions. These may be formed by integrating agricultural, industrial, power grid and transport.

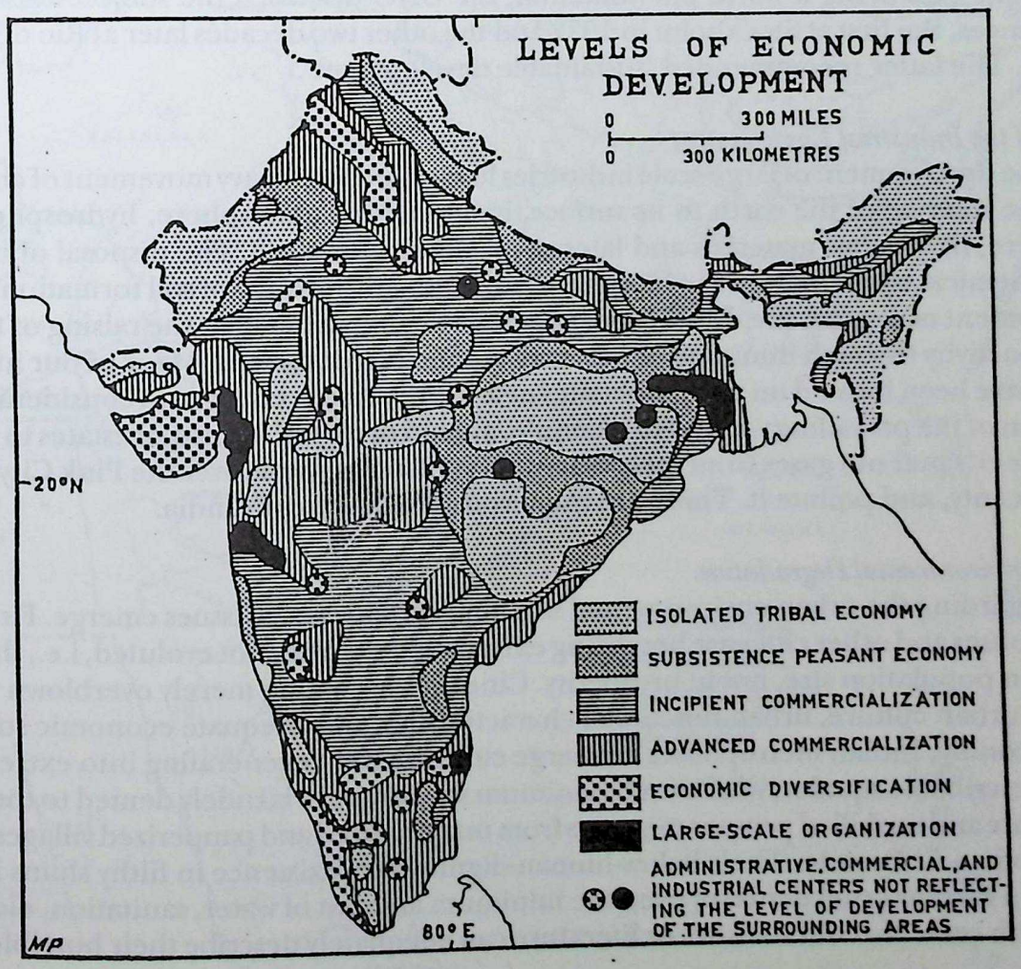

Fig. 8: Levels of Economic Development: By 'subjective integration' approach, one of the three methods discussed in the source J.E. Schwartzberg in *Annals*, Association American Geographers, 52 (1962).

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Macro Planning Regions

India can be divided into seven planning regions for resource development by grouping states approximately falling with in drainage basins as follows:

1. North-Eastern region	Assam, Manipur, Tripura, and other North-eastern States.
2. Eastern region	West Bengal, Bihar and Orissa.
3. North-central Region	Uttar Pradesh.
4. Central Region	Madhya Pradesh.
5. North-western Region	Punjab, Haryana, Rajasthan, J&K, Himachal Pradesh.
6. Western Region	Maharashtra and Gujarat.
7. Southern Region	Tamil Nadu, Karnataka, Andhra Pradesh, Kerala, Goa, Pondicherry and all the Islands.

Environmental Issues

Environment is itself a dynamic, complex entity. It is constantly changing as a result of human activities and infringements, which lead to disturbances of the balance of nature. Earth and its biosphere, its climate and life-supporting system have ominously deteriorated in recent times due to very rapid urbanization and industrialization. The consequences are the warming of the global climate, sea level rise, depletion of the ozone layers, desiccation, and so on. This being a world phenomenon, the UNO discussed the subject at two world conferences, the first at Stockholm in 1972 and the other two decades later at Rio de Janeiro in 1992. The latter recommended 'sustainable development'.

Status of the Industrial Environment

The development of large-scale industries has led to a very heavy movement of chemicals from the interior of the earth to its surface, including the atmosphere, hydrosphere, and biosphere, first as raw materials and later as products and wastes. The disposal of iron and other chemical elements into the biosphere is affecting the process of soil formation and the development of organic life. Especially dangerous to human health is the raising of the level of radioactivity through dumping of wastes of atomic power stations. Many of our industrial plants have been located on unsuitable sites near cities without taking into consideration the direction of the prevailing winds. For example, a chain of several industrial estates to the west of Jaipur city puff out gases from their chimneys to blow eastwards over the Pink City, known for its beauty, and pollute it. There are numerous similar cases in India.

Urban Environmental Degradation

Regarding the urban environmental situation certain crucial issues emerge. Firstly, our metropolises and other cities are becoming extremely involuted, not evoluted, i.e., they grow merely in population size, not in prosperity. Cities are becoming merely overblown villages, without urban culture, urban functional characteristics, and adequate economic strength.

Secondly, Indian metropolises and large cities are fast degenerating into extreme filth and indescribable squalor; where even minimum shelter space is rudely denied to the masses of illiterate and unskilled peasant migrants from marginalized and pauperized villages to their metropolitan El Dorado. Their below-human-dignity-level existence in filthy slums is aggravated by a further cruel denial of even the minimum amount of water, sanitation, electricity, and health care. No cold statistics or literature can adequately describe their horrible plight.

Protection of the Environment

How seriously the environmental issues are taken, may be gauged from the fact that stringent laws have been enacted to punish those infringing laws, enacted to protect the

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environment. The Supreme Court of India has ordered the closure of hundreds of industries around the Taj Mahal in Agra if they fail to shift out of the Taj 'trapezium'. The printing industry (cottage and small scale) at Pali and Balotra in west Rajasthan has not only polluted the water of the wells, but also the nearby rivulets into which it is drained. The heavy doses of fertilizers and pesticides (insecticides, herbicides, fungicides) administrated on fields under the Green Revolution have polluted the water flowing from the fields to rivers and lakes, and have also contaminated the grass on which animals graze and birds feed. They have even contaminated mothers' milk, leading to health problems among infants. These issues are being widely discussed among scientists all over the country. The Dal Lake, the Chilka Lake,

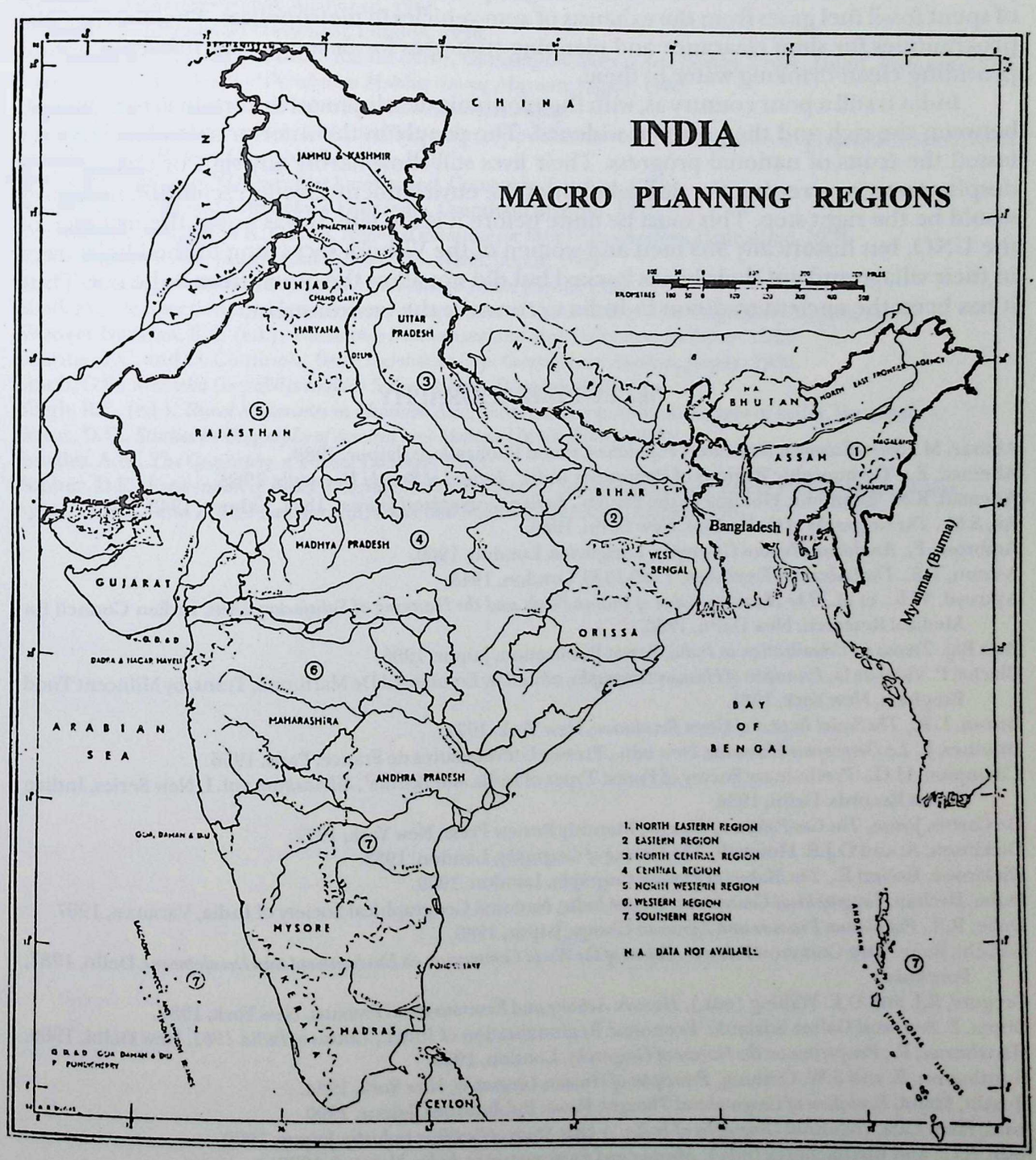

Fig. 9.

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the Killeree Lake, etc., have been polluted beyond permissible limits. Government and non-government organizations are assisting society in ameliorating the environmental degradation and devising means to protect it from further degradation. The felling of trees has been banned and extensive afforestation schemes are being implemented. To save rare birds, like the Siberian crane, and animals like the Asian lion, from extinction, national parks have been developed. The desert dunes are being stabilized, cultivation of steep hill slopes is restricted. Similarly, expressions of our cultural heritages, like the temple of Konark, the havelis of Jaisalmer, the Taj Mahal of Agra, and the caves of Ajanta and Ellora, are being protected and preserved scientifically. Restrictions are being imposed on the blowing of horns and emission of spent fossil fuel gases from the exhausts of auto-vehicles in metropolises. There are special programmes for slum clearance and planning strategies for decongesting urban areas and providing clean drinking water to them.

India is still a poor country as, with the economic development in certain areas, the gulf between the rich and the poor has widened. The people in the interior areas have not yet tasted the fruits of national progress. Their lives still show hardly any sign of change. But despite poverty, arresting the degradation of the environment through scientific measures would be the right step. This must be done before it is too late. It was not at the instance of the UNO, but historically 363 men and women of the Vishnoi sect clung to the khejri trees in their village and got their heads hacked but did not allow the green trees to be cut. Thus it has been the ancient tradition in India to conserve the environment.

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CHAPTER V

Approaches to Indian Ethnography

Badri Narayan Tiwari

O the people of Bhārata
Come and let us weep !
Ha ha the deteriorated condition of Bhārata
We cannot see !!
Bhārtendu Hariścandra, 1875

A concept that invited both action and reaction in the realm of Indian ethnography is, 'India is a mere geographical expression, that there are Bengalis, Rajputs, Punjabis, Gujaratis, Marathas, Sikhs, Parsis, Muslims, Christians, and many other people, but no Indians; in fact, there is no such thing as India at all.' As a reaction to this the counter concept originated: 'India' is one, though it is composed of these diversities, leading to the popularity of the expression, 'Unity in Diversity'.

It was, in fact, the colonial dictum which influenced Indian ethnography. When counterpoised against the former, pre-colonial paradigm it left behind the holistic conception and projected fragmented pieces of Indian society. In place of 'Diversity in Unity', 'Unity in Diversity' gained significance. It was this thought which was instrumental in providing a form to Indian ethnography. Till date, Indian ethnography has been broadly developed within the framework of Race, Caste, Community and Language.

'INDIA' DISCOVERED

The colonial India, which tainted our intellectual horizon, has been constructed to a great extent within the imperial-colonial framework. Thus, it is this perception of India in the nineteenth century which even today is at the centre of our policy-making endeavours.

John Keay (1983) in his book, *India Discovered,* described the first cause for the discovery of India. 'The first cause was in the paternalistic nature of British imperialism that attracted the Western scholars and scientists. The men who discovered India came as amateurs, by profession they were soldiers and administrators.' Another cause of the discovery of India was the logic of colonialism and imperialism. According to this very logic colonialists, first of all, try to understand the society ethnographically, historically, sociologically, economically and culturally. The society which they rule needs to be understood by the rulers, policy makers and administrators. So the 'colonizers' discovered the 'colonized', largely guided by their interests, and presented the discovery in such a way that it created a link between the

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colonizers and the colony, to bring it at par with the civilization of the age. Susie Tharu (1991) has explained this very nature of the discovery of India thus:

> The beginnings of Indological studies are associated with William Jones (1746-94) who was an official of the British East India Company, and other studies arose in response to the demands made by the Company, as it extended its early commercial interests into political ones, for a knowledge of the history, the legal practice, and the customs of the people who were to be governed.

The third cause of the discovery of India lies in the nature of orientalism. We should agree with Edward Said's well known argument about orientalism. According to him both the Indologists and the Utilitarians (who were their fiercest opponents in India) were Orientalists – in Said's sense of term, their orientalism stands for the representation of the 'Orient's special place in European Western experience' as its 'cultural contestant' or 'other'. It includes the persistent schemes and traps by which the orient is 'contained and represented by the dominating (occidental) frameworks' (Said, 1978). Because of these ideologies colouring the discovery of India, Mill discovered Indian culture as 'primitive', immoral and rude.

The two Indias were discovered by 'outsiders'. As a reaction against both the theories, the nationalists discovered a 'third India' which was not a blueprint of another India but was a predictable reaction of a wounded class inflicted with the sense of inferiority as depicted in the two versions. Nehru's *Discovery of India* reflects this ideology, that is, a response to views taking hostile courses. It was felt that, within these two constructs of India and ethnography, the real India somewhere fails to identify its locational point and this impeded scholastic discourse and polemics. The inclusion of the third aspect led to the creation of a pyramid of literature of three varieties, producing further sophistication and confusion.

RACIAL ISSUES

The idea of race constitutes the subject of a vast literature in Indian ethnography, thus providing it a greater leverage over other aspects.

Some anthropologists see India's population as forming a basically ethnic continuum, one with varying substocks or at best two races (Keith, 1936; Hooton, 1946, pp. 612-24; Coon et al., 1950, pp. 122-9; Boyd, 1954, pp. 400-3). A number of anthropologists like Risley (1915), Hutton (1933, pp. 430-61), B.S. Guha (1935, 1937, 1944) and S.S. Sarkar (1954) have made extensive study of the racial history and ethnic composition of India. Risley, basing his classification on metric criteria, viewed undivided India as being made up of seven racial groups, occupying specific blocks of territory. These were:

1. *Turko-Iranian* – Baluchistan and Northwest Frontier Provinces, now in Pakistan
2. *Indo-Aryan* – Punjab, Rajputana and Kashmir
3. *Scytho-Dravidian* – Gujarat, Southwest Sindh, Bombay
4. *Aryo-Dravidian* – Gujarat, Southwest Sindh, Bombay
5. *Mongolo-Dravidian* – Bengal and Coastal area
6. *Mongoloid Type* – Himalayas, Assam and Nepal
7. *Dravidian* – Madras, Andhra, Kerala, Madhya Pradesh, Highland Orissa, Southern Bihar, Hyderabad

Risley also advanced the opinion that there was a direct relationship between physical types and languages used. He also took the relationship between race, language and culture as an established fact, and attempted to use linguistic and cultural criteria in delimiting the racial groups. Risley's classification continued to be accepted until an alternative and more

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acceptable classification was proposed by Guha (Dube, 1990). B.S. Guha put races into two types, viz., original races and progressive races. He traced one or more racial strains in contemporary Indian population. In his later writings, he identified the areas in terms of respective racial spread-outs. These are:

1. *Negrito* – Hills in Travancore
2. *Proto-Australoid* – Tribal areas in Central and Southern India
3. *Mongoloid* – Himalayan fringe, Assam
4. *Paleo-mediterranean* – South India and lower classes in North India
5. *Mediterranean* – North India
6. *Oriental type* – Punjab, Sindh, Rajputana and Western UP
7. *Western Brachyacephals* – South Baluchistan, Sindh, Rajputana and Western UP
8. *Nordic* – North-western India.

Guha has given us a very detailed classification for the Indian population. He has viewed India's population as being of a basic type with regional variations, which are due to intermixture, and combination and re-combination of intruding groups with basic types.

Of these, the first three are the older residents of the subcontinent. They are confined to small pockets. In the south, the Kedar, the Irula and the Paniyan, and in the Andaman Islands the Onge and the Andamanese have definite negrito characteristics. Some traits of this group are found among the Angami Naga and the Bengali of the Rajmahal hills. The proto-Australoid group is numerically more significant. Most of the tribes of middle India belong to it. The Mongoloid group is subdivided in two branches – Paleo-Mongoloid and Tibeto-Mongoloid. Tribal groups in the Himalayan region and those in the North-east are Mongoloid. Some Mongoloid features are seen in the non-tribal population of the eastern states – Assam, West Bengal, Manipur and Tripura. These ethnic groups can be regarded as autochthonous, the negrito were possibly followed by the proto-Australoid.

The later arrivals into India were the mediterraneans, the western Brachycephals (subdivided into the Alpinoid, Dinaric and Armenoid groups) and the Nordic (Indo-Aryans). The Nordic were the last major ethnic element to arrive in India. But before they came, the Indus valley civilization had slowly developed in India. Guha's intervention in the debate concerning the racial composition of India invited much discussion and criticism. Among the critics of Guha's classification, S.S. Sarkar deserves a special mention, because in many of his writings he has proposed an alternative classification of the following racial groups occupying specified areas:

1. Australoid
2. Indo-Aryan
3. Irano-Scythian
4. Mundary speaking
5. Malaye-Polynesian
6. Mongoloid

He defines the Negrito element as the basic substratum in the Indian population as was proposed by Guha. His insistence is on linguistic categories in the racial classification. He emphasized the relationship between language and race.

These then are the three principal descriptive models available in the earlier Indian Ethnography. Viewed from different angles, such classifications have been subjected to scathing criticism but the fact remains that they opened up a large area for research in Indian Ethnography in the period that followed.

CASTE AS SUBJECT OF INDIAN ETHNOGRAPHY

An ethnography of India based on caste lays special emphasis on caste in its analysis and interpretation. There is no doubt that caste is the most typical social institution of India.

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Western scholars have devoted much attention to it and have given various explanations of its origin. According to some authorities, it arose from the domination of the white-skinned Aryan people who invaded India some four thousand years ago. To avoid being absorbed into the darker-skinned Dravidian-speaking people, they adopted a segregative policy. This policy, working on pre-existing groups such as the family, clan, and the tribe which governed the people might have provided the germ from which caste has grown. Another view is that the caste system in its main essentials was borrowed by the white-skinned invaders from their dark-skinned subjects, by whom it had already been elaborately developed from an origin that was partly totemistic. That the Aryan speakers were profoundly influenced by the people whom they conquered is, indeed, certain, for the original Aryan deities – bright nature gods rather like those of the early Greeks – were gradually displaced by countless numbers of gods and goddesses which give the impression that they originated in darker, and more primitive beliefs.

But whether the caste system was devised by the Aryan-speaking invaders or whether they found much of it already developed by the conquered people who, in their day, had also once been invaders, its influence has shaped the socio-religious structure of India for at least three thousand years. To the western observer its main effect has been to divide society into an elaborate system of some two thousand watertight compartments, each isolated from the others by fear of ritual pollution in connection with such matters as marriage and the taking of food. The whole structure is bound together by religious principles, by the reverence and respect enjoyed by the priestly class, by the deep determination of individuals to respect one's own caste rules. Another point of view suggested by L.F. Rushbrook Williams is that the caste system appears as an iron bond of social tyranny, the effect of which is to fix each individual's status, though not perhaps his manner of living or wealth or personal prestige, in accordance with the accident of birth binding him by formal rules which prescribe and restrict his habits, his marriage, his diet, and even sometimes, his occupation.

One may thus identify four perceptions of caste:

(a) Caste as a search for harmony through limiting interaction
(b) Caste as social tyranny
(c) Caste as a system of the hierarchy of dominance
(d) Caste as a system of ritualized divisions based on religion

CASTE: THE INDIAN VERSUS THE WESTERN VIEWPOINT

But the Indian point of view is certainly different from the western view of caste. According to this view,

> caste is an institution with a definite biological significance: indeed a time-honoured system of eugenics. As the ants and bees are specialized according to the function which each inmate (of the nest/hive) discharges, so, it is held, should men be bred with the spiritual and physical qualities which their work in life requires. Inherently, at least, the four great divisions have no right to be considered as gradations in the social scale: they are, rather, looked upon as necessary parts of a huge organism of which no part may claim to be more essential than the others. Thus the *Brāhmaṇa*, or priests are equated to the head; and *Kṣatriyas*, or warriors and administrators, are compared to the arms; the *Vaiśyas*, or merchants and craftsmen to the legs, and the *Śūdras*, to the feet. In the Indian point of view, all these are required for the due functioning of the social structure, they are equal in value. (Rushbrook, Williams, 1985.)

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Much of the ethnography of India is inspired by the western notion of caste. Herbert Risley (1915), in spite of all his scientific equipment, could not overcome his western bias. Two-thirds of his work is devoted to caste. He has analysed religion, nationality, culture, etc. on a caste base. He has given titles to his works like *Caste and Religion, Caste and Nationality*, etc. To Risley, caste is a collection of families or groups of families bearing a common name, claiming common descent from a mythical ancestor, human or divine, professing to follow the same hereditary calling, and regarded by those who are competent to give an opinion as forming a single homogeneous community. The name generally denotes or is associated with a specific occupation. A caste is almost invariably endogamous. Risley lists the types of caste as follows: (1) the tribal type, (2) functional or occupational castes, (3) sectarian castes, (4) castes formed by crossing, (5) national castes, (6) castes formed by migration, and (7) castes formed by changes of customs.

According to Risley, the tribal type comprehends a tribe like the Bhumihars which had, over the years, insensibly been converted into a caste, preserving its original name and many of its characteristic customs, but modifying its animistic practices more and more in the direction of orthodox Hinduism and ordering its manner of life in accordance with the same model. He has thus classified the Ahir, Dom and Dushdh in UP and Bihar; the Gujar, Jat, Meo and Rajput of Rajputana and Punjab; and the Kali, Mahar and Maratha of Bombay.

Risley describes some castes as functional. The community of functions is ordinarily regarded as the chief factor in the evolution of castes. Every caste professes to have a traditional occupation, though many of its members may have abandoned it, but the adoption of new occupations or of changes in the original occupation may give rise to subdivisions of the caste which develop into entirely distinct castes. Risley described many functional castes like the Sadoeps of Bengal who have, within recent times, taken to agriculture and broken away from the pastoral castes to which they originally belonged. The Madhunapit are barbers who became confectioners. The Chasadhobis are washermen who took to agriculture.

The sectarian type comprises a small number of castes which commenced life as religious sects founded by philosophical enthusiasts who having evolved some metaphysical formula have become castes like the *Liṅgāyata* or *Vīraśaiva* castes of Karnataka and the *Saraks* of western Bengal.

Risley also described national castes. According to him, certain groups, usually regarded as castes today, cherish traditions of bygone sovereignty and seem to preserve traces of an organization considerably more elaborate than that of one ordinary tribe. He classified Marathas, Newars, etc. as national castes.

If members of a caste leave their original habitat and settle permanently in another part of India, the tendency is for them to be separated from the parent group and to develop into a distinct caste, Risley classified them as 'castes formed by migration'. He puts Nambudari or Nampurti (migrated from the West Coast) in this category. Thus, Risley listed 2,378 main castes and 43 races in India.

The census of 1901, which is in fact an ethnographic profile of India, also strongly emphasized the fragmentation of the traditional castes. It made caste a political unit to serve the purpose of planning and policy making. This very census, which was based on the guiding principle developed by Hutton and Risley, focused more on fragmentation, difference and diversity rather than on similarity or unity within the castes or the caste system as a whole.

The popular notion of caste among Western scholars as a type of social stratification is ethnocentric. They must, therefore, liberate themselves from their preconceived ideas (such as ethnicism, egalitarianism, individualism) by which they are trapped, as Louis Dumont suggests. Dumont in his thoughtful writing opined that caste, which undoubtedly stands for inequality in theory as well as in practice, should not be interpreted as a notion which is the opposite of equality and therefore an anomaly or, worse, a perversion. The inequality of the

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caste system is a special type of inequality and the sociologists' principal task is to lay bare its nature. Hierarchy, defined as the superiority of the pure over the impure, is the keystone in the analysis of the caste system. It is the principle by which the elements as a whole are ranked in relation to the whole.

COMMUNITY AND INDIAN ETHNOGRAPHY

The Anthropological Survey of India, under the leadership of Dr K.S. Singh, has completed a project of the Ethnography of Indian Society. The study has been designed to report the findings in 41 volumes. Dr Singh has planned his study of the Indian people on the basis of a more fundamental nucleus namely 'community' rather than caste alone, as his predecessors had done. He defines 'community' as marked by territoriality, the 'we' feeling and partial system (K.S. Singh, 1992). In order to qualify this statement he further explains, 'There are many types of communities, backward and forward, rural and urban, regional and national, and so on' (ibid.). In this project we are concerned with the 'community as generally studied in ethnography which is marked by endogamy, occupation and perception' (Tapas K. Roychoudhury, 1994).

According to this type of Indian Ethnography, the indigenous terms like *jāti, kula, samudāya,* etc. do not spread out on a space as wide as caste, because, for example, *jāti* is an endogamous division and a tribe or caste is a *cluster* of such divisions. In fact, Dr K.S. Singh holds that 'the merger of the divisions with the main body appears to have reinforced the community character' (K.S. Singh, 1992). As Director of the Project of India (POI) Study, he opines that 'A community is a dynamic category, continually redefining itself, its relationship with other communities and its relationship with its social and physical environments.' Dr Singh has cautiously avoided any confusion between a community and a genetic category. By the application of this new principle 2,795 communities in India have been listed and by their distribution over states/union territories the POI Study reaches a figure of 4,635 communities.

In the Volume Nine of this project, report is devoted to sharing, interaction and linkages under the subtitle, 'An Atlas of Biological, Cultural and Linguistic Traits'. Languages, on very justifiable grounds, have been studied for classificatory purposes and this study claims to have made a definitive list of 325 languages/dialects, modifying the 1961 Census List of 1,625 languages. While the Census of India (1961) distributed the speakers as Indo-Aryan (73.30 percent) Tibeto-Burmese (0.73 percent), Dravidian (24.4 percent) and Austro-Asiatic, 6,192,495 persons, this community-based ethnography listed community-wise language distribution as Indo-Aryan (2549), Dravidian (1032), Tibeto-Burmese (175), Austro-Asiatic (44), Indo-Iranian (5), Andamanese (4) other languages (15) and unclassified languages (25).

Despite the diversity of these language families there is some commonalty. In terms of kinship terminology, the same or similar words for father, mother, grandfather, grandmother and uncle are very commonly used in all the four language families. The multiplicative numeral system of the Indo-Aryans was borrowed by the Austro-Asiatic languages. In all the languages, adverbs and adjectives generally occur before verbs and nouns respectively. Numeral classifiers, too are common to the languages belonging to the four families, excepting in some cases. The colour terms used in Indian languages show a commonness not only from the point of view of the words used for different colours, but also of common arrangement at the semantic level of their use and derivation.

For grouping societies in India, family operational systematics have been held by the POI group as the single efficiency indicator and has been narrowed down to specific situations

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according to convenience. As a result, phratry, moiety, band organization and clan organization have been used to cluster Indian communities.

Phratry is found among 151 communities, belonging mostly to the Scheduled Tribes, including the Mod tribe of Central India. The second largest concentration of phratry is in the North-east – Arunachal Pradesh, Manipur and Meghalaya. Moiety is found in 64 communities, most of which are tribes. The POI volume on Arunachal Pradesh reports the highest incidence of moiety followed by Nagaland. Band organization is reported from 16 hunting and food-gathering communities. Clan organization is the most pervasive and is said to be followed by organizations based on lineage. Clan and lineage social formations are reported to exist in caste societies. But they are also strong in clans in the tribal society of Mizoram, Nagaland, Arunachal Pradesh and in parts of tribal mid-India. While social divisions indicate descent and status, they also seek to indicate social and land control. Kinship traits have been divided as prevailing in four regions, Eastern, Southern, Western and Northern, in which marital status has also been studied. While the majority of the Indian communities are monogamous, 839 communities practice polygamy along with monogamy and among them 680 communities appear to practice sororal polygamy. Polyandry is reported from 7 communities, fraternal polyandry from 28 communities and non-fraternal polyandry from 5 communities, junior levirate (non-formal) in 1406 communities, junior levirate (formal) in 1201 communities, senior levirate (non-formal) in 195 communities, senior levirate (formal) in 230 communities, junior sororate (non-formal) in 2960 communities, junior sororate (formal) in 2441 communities, senior sororate (non-formal) in 196 communities, and senior sororate in 251 communities. The nuclear family is the predominant type, reported from 2272 communities, horizontally extended among 536 communities and mixed extended in 518 communities.

This community-based ethnography also studied the concepts of purity and pollution and pollution due to death in the family has been reported from 3925 communities and post-natal pollution in 4189 communities. The rites of passage have been related as pre-natal (2393), naming ceremony (3426), *muṇḍana* for boys (2843) and for girls (1755), *annaprāsana* (1426), thread wearing ceremony (690), puberty rites for girls (1200), and ancestor worship. This ethnography reported on 2779 rural communities, 393 communities in urban areas and 1336 communities in both rural and urban settings. Most of the urban communities have been reported to be congregations of rural immigrants and amongst the Muslims, Jains and Christians there is an overtone of urban concentration.

Varṇa awareness has been found to be widespread: 68.5 percent of the communities are conscious of it although there are variations in this awareness from north-west to Bihar and Orissa. The least awareness sectors have been found in the remote tribal areas. More than half of the Indian communities (2804) admit their acceptance of the *varṇa* order. Of the 584 Muslim communities studied, 53 still recall their place in the *varṇa* system, 12 of them as Brāhmaṇas, 24 as Kṣatriyas, 6 as Vaiśyas and 22 as Śūdras. Among 339 Christian communities, 8 consider themselves Brahmins, 23 as Kṣatriyas, 7 as Vaiśyas, and 48 as Śūdras.

This ethnography also identified 42 major occupations and 307 current occupations, bringing the total to 349 all over the country for 4635 communities.

The guiding principle of this ethnographic project study is to explain and propagate the areas of commonalty of the Indian people.

ETHNOGRAPHY OF LANGUAGE

A question worth considering is: When and how did language become an important issue for serious enquiry in ethnological science?

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A merchant from Florence, Filippo Sassetti, while on a business trip to Goa for about five years from 1583 was struck by similarities between Italian (or Latin) and Sanskrit. Thus an important question emerged, why there should be similarities among different languages? Joseph Scalingar (1540-1609) for the first time discussed this question seriously. (Mukherjee, B.N., *Indian Express*, September 15, 1970).

Scalingar divided the languages of Europe into four groups and tried to ascertain the nature of the relationships among the groups. In 1767, James Parsons, on the basis of the Biblical story of the resettlement of the world after the great deluge by Noah's three sons, Shem, Ham and Japheth, divided the then known human groups and languages into three families and into three sections:

1. Semites (Arabs and Jews)
2. Hamites (Egyptian and Cushite)
3. Japhetic (Greek, Italic, Germanic, Slavic and even Iranian [Persian] and Indic [Bengali] language).

William Jones (1786) raised some questions about linguistic similarities and differences. The common source of the primitive language was called 'Indo-European' after a suggestion by Thomas Young in 1813. In the first half of the nineteenth century, the real foundations of the study of Indo-European philology was laid by F.S. Schlegel, J. Grimm, R. Rask and Franz Bopp.

In 1847, Max Müller labelled Sanskrit and related languages Aryan in contradistinction to the aboriginal languages of India. J.C. Pritchard thought of an original racial stock (Aryan) whose descendants, speaking related languages, had spread from Scandinavia to the Ganga.

In Indian ethnography, Risley was convinced of a direct relationship between physical type and languages. But Guha essentially reversed Risley's approach and turned to the relation between race and geography, and first examined geographical areas to find out the racial composition in a specific area. S.S. Sarkar's insistence on linguistic categories in racial classification revives the importance of Risley's thought and leads us to reconsider the relationship between language and race. In spite of all these debates, the issue of language continues to be the least studied phenomenon in Indian ethnography. Except for the census figures, Grierson's linguistic survey volumes and some sporadic works (Chatterjee, 1954; Emeneau, 1956; Sharma, 1990), there are wide gaps to be covered in the theoretical and descriptive studies of the languages of India.

Emeneau (1956) pointed out that India is a linguistic area, meaning thereby an area which includes languages belonging to more than one family but showing traits in common which are found to belong to the other members of one of the families. Chatterjee (1951, 1953) earlier came to a similar conclusion and also found evidence of the influence of Austric languages on Sanskrit. A similar role has been proved for the Dravidian languages.

India is still a land of many languages and dialects which are mutually unintelligible. However, owing to their mutual contacts for over 3000 years or so, major similarities in structure have evolved and we have to view India in terms of its languages and races sharing many things in common. So, one is justified in calling India a distinct linguistic area.

In India three major language stocks have been identified. They are Indo-Aryan, Dravidian and Austro-Asiatic (Grierson, 1927).

Indo-Aryan, to follow Grierson, is divided into the following literary and vernacular languages: Assamese, Bengali, Bihari, Oriya, Eastern Hindi, Western Hindi, Rajasthani, Gujarati, Marathi, Punjabi and Pahari. Eastern Hindi and Bihari, in turn, are divided into three dialects: Bhojpuri, Maithili and Magadhi. Gumperz (1957) discovers further variations in 'regional standards' which he terms local dialects. The principal Dravidian languages are Tamil, Telugu, Kannada and Malayalam. Other minor Dravidian languages are Tulu, Kodagu

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and a number of tribal languages such as Gondi, Toda, Kurukh and Matto. The Austric-Asiatic languages are spoken by tribal people, the principal ones being Mundari, Santali, Ho, Khasi, Bhili. The tribals of the north-eastern border area, except in the Khasi hills area, speak dialects related to the Tibetan and Burmese languages.

Grierson classified 179 languages and 544 local dialects in India. But 130 out of 179 belong to the Bhotchini, Monkha, *Mer, Karen* and *Man* linguistic groups. These are minor groups residing in Indo-Burmese border territory.

Risley and Sarkar, as mentioned above, postulated a very close relation between race, language and culture. Suniti Kumar Chatterjee (1951, 1953) relates Guha's physical types to language families and tries to determine the contribution of these language-culture groups.

Suniti Kumar Chatterjee (1954), on the basis of linguistic palaeontology, traces some part of the pre-Aryan linguistic composition of India. He groups the major pre-Aryan languages in India as follows: Negrito, Austro-Asiatic, Monkhmer tongues and Dravidian. Contributions of each one of these have entered into the texture of Indian culture.

CONCLUSION

Although Indian ethnography has made some successful attempts to study the structure of Indian society and the way of life of the Indian people, yet certain important questions arising out of such studies and their discussion have remained unanswered. In the imperialist period, Indian ethnography was influenced by colonial issues and ideas; it had been reduced to a story of others told by others rather than one's own tale. In such ethnographic descriptions only some actors, a few typical characters and some events could be identified as Indian. The soul of ethnographic descriptions by and large remained colonial. Even after independence came, whatever Indian ethnography reconstructed was largely a reflection of the nineteenth century's colonial vision. The distortions of nineteenth century positivism have been the mainstay of contemporary ethnography. In such descriptions man and society have been projected as mere objects and ethnographic studies have been dominated by academic fashions and theological jargon. They have ignored the basic 'search of the self', the transformation of self into other and the internalization of the other into the self. Owing to the fact that the dialectical relation between the self and the other could not be properly grasped by ethnographers, there developed the 'all-engulfing methodology'.

In some cases, Indian ethnography projected the inferiority complex of a conquered nation. For this reason, historical and ethnographical statements have remained mostly restricted to 'The Aryans came, the Aryans saw, the Aryans conquered' (Chatterjee, 1954). For example, Indians long nurtured the myth that, before the advent of the Aryans in this country, its original inhabitants were barbarians. Similarly, it has been forcefully argued that, before the advent of the British, the inhabitants of this country were uncivilized. Before the coming of the Aryans the richness of the non-Aryans civilization and its contribution in the making of the later Aryan and Hindu society have been ignored in most contemporary ethnography. However, today the very concept of the advent of the Aryans in the Indian subcontinent is being questioned (Bhagwan Singh, 1990).

Most ethnographic descriptions have perceived Indian society as a 'Melting-pot of Races and Tribes'; the intricate harmonies and conflicts of its structure have somehow missed adequate attention.

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SECTION III

PREHISTORY, TECHNOLOGY AND SOCIAL EVOLUTION

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CHAPTER VI

A Brief Note on Indian Stone Age Archaeology

V.D. Misra

Much water has flown down the Ganga since the first discovery of Lower Palaeolithic tools at Pallavaram near Chennai.[1] The archaeological investigations carried out over the years, particularly investigations after 1947, have established the Stone Age cultures of India on a firmer footing. The data collected from different parts of the country have not only established the stratigraphic horizon but also tool-typology, technology and ecology of Stone Age man. As in western Europe and Africa, the Stone Age cultures in India also display a developmental sequence. These can be divided into Palaeolithic, Mesolithic and Neolithic. This division is based at places on stratigraphic considerations. The Palaeolithic culture in India is further sub-divided into three phases – Lower, Middle and Upper.[2] In the following pages an attempt is being made to pinpoint the salient features of various Stone Age cultures as per their extent, stratigraphy, tool-typology, technology, ecology and chronology.

THE LOWER PALAEOLITHIC CULTURE

In the Indian subcontinent the Lower Palaeolithic culture is broadly divided into two zones – primarily a pebble-based culture in the north and north-western India, and the Acheulian in the rest of the country.

The chopper/chopping tools fashioned on pebble have been obtained in the Sohan Valley in the Potwar region in Pakistan, Kashmir Valley and Kangra District in Himachal Pradesh. As the first tools of this facies were obtained in the valley of the Sohan, a tributary of the Indus, it is referred to as Sohan or Soan Culture. The Yale and Cambridge expedition of de Terra and Paterson gave a geological and chronological framework to the tool-bearing horizons.[3] The tools are fashioned primarily on pebble and these are found in the first terrace of the Sohan. In this connection, it may be pointed out that this pebble tool tradition is also widely distributed. Its occurrence has been noticed in Central Asia, North China, South-east Asia on the one hand, and different parts of Africa on the other. In India also, pebble tools have been obtained from a number of Acheulian sites but everywhere their number is meagre.

British archaeologists, working in the north-western region (Pakistan), have suggested a high antiquity to this culture on the basis of magnetic polarity stratigraphy. As per their claim, the earliest tools in this area can be dated to two million years ago.[4] Though in the

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present state of our knowledge this date is quite exciting in the Indian context, the high antiquity already suggested to the pebble-tool cultures of central Asia deserves attention.

ACHEULIAN CULTURE

Hand-axes, cleavers, etc. have been found in different parts of the country. Their occurrence is noticed in Tamil Nadu, Andhra Pradesh, Karnataka, Maharashtra, Orissa, Bihar, Madhya Pradesh, Uttar Pradesh, Gujarat, Rajasthan, West Bengal, Haryana and the Garo Hills in Meghalaya. In the north-western region, in the Sohan Valley also such tools have been found but in a very limited number. In the Indian subcontinent, Acheulian tools have been obtained in different contexts. In the north-western region these have been found imbedded in Terrace I. In the Eastern Ghats these are found in detrital beds. At places they are found at factory sites where men had been manufacturing tools. Such sites have yielded not only finished tools but also debitage, cores, flake fragments and unfinished tools. At a number of sites in Madhya Pradesh, Uttar Pradesh and Bihar, Acheulian tools are obtained from the basal gravel of the rivers, indicating thereby that their stratigraphy represents the earliest tool traditions of Stone Age man in India. In Madhya Pradesh the Acheulian people occasionally occupied rock shelters also as is indicated at Bhimbetka and Adamgarh.

The gravel formations associated with Acheulian tools have also yielded animal fossils in the valleys of the Narmada and Godavari on the one hand and of the Belan and Son[5] on the other. The available animal fossils are ascribed to *bos, bubalus, elephus, equus,* hippopotamus, chelonia, etc. The nature of the deposits and the occurrence of some animal bones indicate the prevalence of tropical humid condition during the time.

The tool typology comprises hand-axes, cleavers, scrapers, knives, spheroids, sub-spheroids and, occasionally, pebble tools. The raw material used for making tools displayed regional variables. The choice of raw material was conditioned by the geology of the area and the availability of the rocks. At most of the sites where quartzite was available it has been extensively used. At places, however, quartz is selected. In western Maharashtra tools have been fashioned on basalt or dolerite. In Karnataka, in the Hunsgi Valley, tools are mainly made on limestone, while in northern Bundelkhand, where the coarse-grained granite was available, it was used as raw material.[6] At places chert-based tools have also been found.

The chronology of the Acheulian culture in India is in a melting pot. The co-occurrence of primitive and evolved tools from the same horizon has also complicated the issue. Recently, at Bori near Pune, a volcanic ash has been dated by potassium organ to 1.4 M years.[7] As this deposit underlies a gravel deposit containing an early Acheulian assemblage the latter would be younger than the date obtained. Efforts are also on to date Acheulian sites by thermoluminescence (TL) and U/Th decay series techniques. Dates obtained on these techniques to the sites of Umrethi in Saurashtra and Didwana in Rajasthan indicate that the Acheulian culture at these sites is older than two hundred thousand years. There is every likelihood that future researches may place this culture somewhere between 2.00 to 0.7 M years ago. In certain areas the Acheulian tradition might have persisted even up to Upper Pleistocene.[8]

The occurrence of a cranium of *Homo erectus* at Hathnora near Hoshangabad in Madhya Pradesh in the basal gravels of the Narmada indicates that the Acheulian culture of India, as elsewhere, was the handiwork of *Homo erectus.*[9]

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MIDDLE PALAEOLITHIC CULTURE

The isolation of Middle Palaeolithic tools from the Lower Palaeolithic on the basis of stratigraphy occurred quite late in India. It was in 1956 that Sankalia noticed the occurrence of such tools in a separate and distinct horizon at Pravara in Maharashtra. This discovery established that, in the rivers where there are two gravels, the Middle Palaeolithic tools are obtained from the second gravel whereas the first or the basal gravel yield Acheulian tools. The discovery at Pravara had a far-reaching impact on Middle Palaeolithic studies in India. A distinct stratigraphic horizon was accorded to this culture. Subsequent researches brought out the occurrence of this type of tools from Tamil Nadu, Andhra Pradesh, Karnataka, Maharashtra, Gujarat, Rajasthan, Madhya Pradesh, Uttar Pradesh, Bihar, Orissa, etc., indicating thereby that Middle Palaeolithic culture was quite extensive in India.

The Middle Palaeolithic assemblage consists of different types of scrapers, points, blades, borers, scraper-cum-borers and, occasionally, micro hand-axes, cleavers and pebble tools. Misra rightly observes that tools during this period have become smaller, thinner and lighter.[10] Levallois and discoid techniques have been used in this period for the first time. Tools are fashioned mainly on flakes. Technologically, these tools display advancement in comparison to the tools of the Lower Palaeolithic period. Middle Palaeolithic man had also employed a variety of raw materials such as fine-grained quartzite, chert, jasper, etc. Some of the tools resemble very much the tools of the Middle Palaeolithic culture of western Europe, western Asia and North Africa. In these areas, the Middle Palaeolithic industry is associated with the Neanderthal man, though in India the occurrence of this man has not been reported so far. It is not unlikely that, as elsewhere, in India also he was the architect of this culture.

Like the Acheulian, the Middle Palaeolithic tools are also found in different contexts in different areas. Such tools have been found in the Sanghao Cave near Peshawar, Sohan Valley on the Potwar Plateau, in the rock shelters of central India like those at Bhimbetka and Adamgarh. As in the Acheulian, factory sites pertaining to the Middle Palaeolithic have also been found. Sankalia has rightly pointed out that the Middle Palaeolithic people occupied the same regions and habitat as the preceding Acheulian people.

The horizons of the Middle Palaeolithic tools are associated with faunal remains comprising *Equus nomadicus, Bos nomadicus, Hexaprotodon, palaeindicus, Elephas hysudricus, Stegodon-insiqnis-ganesa,* and *Cervus* species. Incidentally, the Acheulian and the Middle Palaeolithic assemblages are characterized by similar fossils. These fossils suggest a savanna land environment interspersed with swamps and forests.

Like the chronology of the Acheulian, the chronology of the Middle Palaeolithic in India still remains unsettled. However, a number of TL, U/Th, as well as radio-carbon dates have been obtained from some of the sites of western Rajasthan, the Deccan and central India. These dates range from 150,000 to 10,000 BP.[11] It appears the Middle Palaeolithic culture continued up to 40,000 BP, when it was succeeded by the Upper Palaeolithic culture. However, it is not unlikely that in certain areas the Middle Palaeolithic continued to exist in grand isolation even after that.

UPPER PALAEOLITHIC CULTURE

The Upper Palaeolithic, sandwiched between the Middle Palaeolithic and the Mesolithic, constitutes a distinct phase in Palaeolithic Culture. During this period, parallel-sided blades and flakes were used for making tools. In this connection it may be pointed out that, unlike the Middle Palaeolithic, the Upper Palaeolithic industry is blade-based. The blades have been

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detached from long cores by an indirect percussion technique. The resultant blades are converted into different types of tools. In western Europe the Upper Palaeolithic culture is represented by a number of variables. It was during this period that man started making tools on bone also. In the realm of art too the Upper Palaeolithic phase constitutes a distinct chapter. It was during this period that cave art was initiated. On bones we also get engravings. In Europe, climatically this phase is associated with the last phase of the Pleistocene. The Upper Palaeolithic culture is associated with *Homo sapiens.*

In India, though Burkit and Cammiade and Todd had suspected the existence of this culture on the eastern and western coasts respectively, the majority of archaeologists were of the opinion that in India there was no independent horizon of the Upper Palaeolithic culture. They also opined that, as in parts of Africa, in India also Mesolithic industries succeeded the Middle Palaeolithic. But archaeological investigations carried out over the last four decades have established a distinct horizon of Upper Palaeolithic culture. There is ample evidence to suggest that, as in western Europe, western Asia and parts of northern Africa, in India also the Palaeolithic culture was divided into three distinct phases, namely, Lower, Middle and Upper. In this respect the archaeological investigations conducted in the Belan and Son valleys are very significant. In the Belan section there is a continuous succession of stone industry, right from the Lower Palaeolithic to the Mesolithic. The story is repeated in the Son section.

Over the last four decades useful information has been obtained pertaining to the Upper Palaeolithic from Karnataka, Maharashtra, Gujarat, Rajasthan, Madhya Pradesh, Uttar Pradesh, Bihar and the Garo hills in Meghalaya.[12] A number of Upper Palaeolithic sites have been excavated. The available evidence suggests that during the Upper Palaeolithic period there was aridity. Upper Palaeolithic tools have been obtained from the cores of sand dunes in Gujarat and Rajasthan, suggesting thereby that when these dunes where being formed Upper Palaeolithic man was on the scene.[13] Ostrich egg shells have been found from a number of Upper Palaeolithic sites in Rajasthan, Madhya Pradesh and Maharashtra.[14] These indicate prevalence of arid climatic conditions. The Belan and Son sections also furnish ample indications of the arid climatic conditions. In the Son valley Upper Palaeolithic artifacts have been obtained from the Baghor formation which was deposited during a period of aridity. However, on the Eastern Ghats plenty of Upper Palaeolithic sites are reported. This was a relatively humid region.

As in western Europe, the Upper Palaeolithic people in India started manufacturing bone tools as is indicated from the evidence from the Kurnool caves. The principal tool types in use during the Upper Palaeolithic period include scrapers, backed blades, backed knives, points, lunates, triangles, trapezes, burins, choppers, etc.

The Upper Palaeolithic horizons of the valleys of the Belan[15] and Son[16] on the one hand and the Kurnool caves[17] on the other have yielded animal bones ascribed to nilgai, chinkara, four-horned antelope, sambar, chital, barking deer, mouse deer, wild boar, jungle cat, porcupine, hare, monitor lizard, langoor, cattle, hippopotamus, rhinoceros, elephant, turtle, etc.[18]

Archaeological investigation in the Belan and Son valleys have furnished evidence of religious beliefs and practices associated with the Upper Palaeolithic. In this respect the occurrence of a bone mother goddess in the Belan Valley and a shrine associated with the worship of a mother goddess at Baghor-I in the Son valley are noteworthy. In this connection it may be pointed out that around Baghor-I in the Son valley, the laminated stones as were found from the shrine, are still being worshipped by the Tribal people, suggesting thereby the antiquity of such worship to the Upper Palaeolithic period.

From the Upper Palaeolithic horizon have been obtained some art objects also. Beads fashioned on ostrich egg shells and shell, the latter of estuarine origin, have been found from

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Patne in Maharashtra. On three ostrich-egg pieces are engraved criss-cross designs placed between two horizontal lines. Wakankar had opined that the earliest rock paintings of the Vindhyas, executed in green colour, may be ascribed to these people.

A number of C-14 and TL dates from different parts of the country are found from the Upper Palaeolithic horizon. The combined testimony of these dates suggests a date bracket ranging from 40,000 BP to 10,000 BP.

MESOLITHIC CULTURE

The Mesolithic sites characterized by microliths have been found across the length and width of the country, excepting from the major portion of the Indo-Gangetic plain and the north-eastern region. These sites, as indicated earlier, where located in stratified context, succeed the Upper Palaeolithic and, at places, precede the Neolithic and Chalcolithic. For a variety of reasons, the Mesolithic phase constitutes a significant chapter in Indian archaeology. In the cliff sections of the rivers, microliths are found contained in the last geological formation. Mesolithic sites are better preserved. These indicate occasionally quasi-sedentary settlements. The earliest human burials in India are associated with the Mesolithic people. A substantial portion of the rock art of the Vindhyas is also ascribed to this period. A number of Mesolithic sites have yielded a large number of faunal remains, on the basis of which useful information is obtained about the range of animals hunted by these people. On the basis of the identities of these animals, an inference could be drawn on the nature of climate prevailing during the period.

The Mesolithic sites have been reported from different ecological zones, e.g., the arid and semi-arid sandy plains of western Rajasthan and Gujarat, the rocky plateau of Mewar, the hilly and forested country of central India, the hilly tracts of Orissa, the Chhota Nagpur plateau, the semi-arid and rocky Deccan plateau, the Bombay coast, the Telangana plateau and the Eastern Ghats. In certain parts of the country, the Mesolithic people represent the earliest human penetration such as into the Ganga Valley, the Damodar Valley, the Kerala coast, and the Southern Tamil Nadu coast. Needless to say, the Mesolithic people occupied different ecological zones. With their tools they successfully exploited their habitats.

The densities of the Mesolithic sites indicate demographic increase during the period. Palynological and sedimentological studies have shown that at the beginning of the Holocene there was a marked increase in rainfall. The occurrence of food processing equipment at some of the Mesolithic sites and the thickness of the occupational strata suggest that during this period food gathering had started playing a significant role in the life of the people.

A number of Mesolithic sites have been excavated in different parts of the country. Among such sites mention may be made of Birbhanpur[19] in West Bengal, Paisra[20] in Bihar, Baghaikhor,[21] Lekhahia,[22] Morahana,[23] Bhadahawa,[24] Laharia Dih,[25] Chopnimando,[26] Sarai Nahar Rai,[27] Mahadaha,[28] and Damdama (Warikalan)[29] in Uttar Pradesh, Adamgarh,[30] Bhimbetka,[31] Baghor-II,[32] Medhauli,[33] Banki,[34] and Ghagharia in Madhya Pradesh, Langhnaj[35] in Gujarat, Bagor[36] in Rajasthan, Nagarjunkonda[37] in Andhra Pradesh, Sangankallu[38] in Karnataka and Kuchai in Orissa. Of these, Baghaikhor, Morahana, Lekhahia rock shelters I and II, Ghagharia, Bhimbetka and Adamgarh are the rock shelters and the rest are open-air settlements.

During this period tools are fashioned on blades obtained through the punch technique. Blades are converted into parallel-sided blades, backed blades, penknives, lunates, triangles, trapezes, tanged points, side scrapers and end scrapers, burins, etc. During this period bone tools were also in use. In this respect the evidence of the Ganga Valley sites, viz. Sarai Nahar Rai, Mahadaha and Damdama (Warikalan) is very significant. From Bhimbetka bone points, pendants and pieces of antlers with sharp cut marks have also been obtained.

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The Ganga Valley sites have also furnished ear-rings, necklaces and pendants made of bone. From Mahadaha, pieces of antler with groove marks in good number indicate how rings were obtained from these antler bones.

Excavations at Adamgarh, Langhnaj, Bagor, Sarai Nahar Rai, Mahadaha and Damdama (Warikalan) have yielded corpuses of animal bones. The animal species identified include *Bos indicus, Bos bubalus* including *Bos gaurus*, antelope, deer, *Sus*, sheep, goat, *Equus*, rhinoceros, etc. Sarai Nahar Rai, Mahadaha and Damdama (Warikalan) have yielded bones of fish, turtles and birds. At Adamgarh and Bagor, domestication of animal is indicated. Dog, jebu, buffalo, goat, sheep and pig are included in the category of domestic animals at Adamgarh, while at Bagor, sheep, goat and cattle are domesticated.

Pottery has also been reported from a number of excavated Mesolithic sites like Langhnaj, Bagor, Nagarjunkonda, Morahana Pahar, Baghaikhor, Chopani-Mando and Ghagharia rock shelter I. Potsherds are hand-made and are represented by fragments. Incised or impressed designs are also found on these pots.

Burials have also been found at Dorothi deep, Jambu deep and Bhimbetka rock shelters in Madhya Pradesh, Langhnaj in Gujarat, Bagor in Rajasthan and Baghaikhor, Lekhahia rock shelter I, Sarai Nahar Rai, Mahadaha and Damdama (Warikalan) in Uttar Pradesh. The graves are found in habitation areas. Generally one grave contains skeletal remains of a single individual. However, Sarai Nahar Rai, Mahadaha and Damdama (Warikalan) have also furnished evidence of double, triple or four burials in one and the same grave. Some of the graves have yielded burial goods as well in the form of microliths, bone arrowheads, pendants, necklaces and animal bones. The skeletons have been placed in west-east or east-west directions. In most of the cases extended burial is found. However, from Langhnaj and some of the Ganga Valley sites evidence of flexed burials has also been obtained.

Ample evidence has been obtained regarding the aesthetic sense of the people. Ornaments like beads, earrings and necklaces made of bone beads and beads of semi-precious stone have been obtained. Such evidence comes from Damdama (Warikalan), Mahadaha, Adamgarh and Bhimbetka. Numerous painted rock shelters, have been discovered in the Vindhyan area. Some of the paintings are ascribed to the Mesolithic period. The paintings include animal, man, dancing and hunting scenes executed in red, white or black pigments on the natural surface of the rocks. Some of the rock shelters contain habitational deposits indicative of their long occupation. Some have also yielded burials.

The available C-14 dates obtained from a number of Mesolithic sites indicate the chronological range of Mesolithic culture from the beginning of the Holocene to around 2000 BC.[39] In the closing phase, the Mesolithic culture in the Vindhyas was in contact with the Neolithic culture, as is evident from the occurrence of cord-impressed pottery, a diagnostic trait of the Vindhyan Neolithic, in Baghaikhor, Lekhahia and Ghagharia rock shelters.

NEOLITHIC CULTURE

Archaeological investigations over the last five decades have brought to light a number of Neolithic cultures from different parts of the country.[40] These cultures can be placed in seven geographical regions:

(i) North-western India (Baluchistan and adjoining area)
(ii) Northern India (Kashmir Valley)
(iii) Vindhya region
(iv) Mid-Ganga Valley (covering eastern Uttar Pradesh and western and northern Bihar)
(v) South-eastern India covering parts of Bihar and Orissa.

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(vi) North-eastern India covering Assam and sub-Himalayan region
(vii) Southern India covering peninsular India (Tamilnadu, Andhra Pradesh and Karnataka)

Neolithic cultures are characterized by sedentary settlements, cultivation, domestication, ground stone industry, microlithic component, hand-made pottery, etc. However, in north-western and northern India aceramic Neolithic has also been reported. The Neolithic culture of north-eastern India has not yielded any evidence regarding domestication of animals and cultivation. It is also devoid of a microlithic component. The Kashmir Neolithic culture also has not yielded microliths.

The Neolithic culture of north-western India is datable from seventh millennium BC to the middle of the fourth millennium BC[41] and that of northern India is datable from 2800 BC to 1500 BC. The chronological bracket of the Vindhyan Neolithic ranges from 4000 BC to 1200 BC in the light of calibrated dates. The Neolithic culture of the mid-Ganga Valley is datable from 2000 BC to 1500 BC. The combined testimony of C-14 dates suggests a time bracket ranging from 2500 BC to 1000 BC to the Neolithic culture of South India.

The excavations at Neolithic sites have furnished useful information about domestication, cultivation, etc. The available evidence suggests that wheat and barley were cultivated for the first time in north-western India. Mehargarh has produced the earliest evidence in this regard in the Indian subcontinent. The cultivation of cotton, previously ascribed only to Harappan culture, is also now associated with the Neolithic Culture of Mehargarh. Similar is the case with the domestication of the buffalo. It was previously thought that for the domestication of this animal credit should be given to the Harappans but now the Neolithic phase of Mehargarh has yielded bones of domesticated buffalo. The cultivation of rice appears to have been initiated in the Vindhyan area.

The available evidence suggests that the Neolithic people were capable of exploiting their habitat as indicated by regional variables in their culture.

To sum up, the Indian subcontinent has been inhabited right from the Lower Palaeolithic. The Lower Palaeolithic culture has two facies – a chopper/chopping tool tradition concentrated in the north-west and north of the Indian subcontinent and the Acheulian tool tradition prevailing in other parts of the country. Like western Europe, western Asia and part of northern Africa, the Palaeolithic culture of India is divided into Lower, Middle and Upper Palaeolithic. Archaeological investigations have indicated gradual evolution from Lower Palaeolithic to Neolithic through the Middle Palaeolithic, Upper Palaeolithic and Mesolithic. From Lower Palaeolithic to Mesolithic there is a good deal of uniformity in the tool typology and technology of Stone Age cultures. During the Mesolithic period, man started penetrating new areas, the Ganga plain, etc. The earliest known burials in India are also ascribed to the Mesolithic phase. The Mesolithic period also witnessed quasi-sedentary settlement, emphasis on a food-gathering economy, manufacturing of ornaments, domestication of animals in some areas, and rock art. With the onset of the Neolithic phase, regional variables become pronounced. Man started exploiting his habitat in a more efficient and organized way. The available evidence demonstrates that, in north-western India, the Neolithic culture prepared the way not only for the emergence of Chalcolithic centres but also for the emergence of urbanization as well.

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CHAPTER VII

Prehistoric Technology

Prakash Sinha

Archaeological literature dealing with India's prehistoric period, especially its lithic technology, is almost silent on the chrono-stratigraphic position of Stone Age cultures, specially of earlier cultural periods. In spite of the sincere efforts of Indian archaeologists, the traditions therein are not well-defined as in the case of Africa and Europe. However, archaeological field work over the last few decades has indeed provided valuable material in mapping prehistoric India (Figs. 1-5). Prior to 1964, the African model was applied to classify Stone Age cultures and thereafter the European model. Moreover, no independent typological list of classes and sub-classes of artifacts was made to analyse lithic artifacts; rather attempts have been made to 'fit-in' cultural material recovered in the Indian subcontinent into either the African or the European system of classification. Under these constraints, an attempt is being made in the following pages to understand why man made tools; what his basic and major specialized techniques were; what were the turning points in his long journey developing his lithic technology; what the aims and consequences of developing lithic technology were and, then to propose a methodology to identify elements of Indian culture in prehistoric times.

WHY MAN MADE TOOLS

Oakley has rightly pointed out that ,

> In process of evolution man avoided any such specialization, and retained the plaint five-fingered hands which were so useful to his small tree-dwelling ancestors. When the immediate forerunners of man acquired the ability to walk upright habitually, their hands became free to make and manipulate tools – activities which were in the first place dependent on adequate powers of mental and bodily coordination, but which in turn perhaps increased those powers . . . Employment of tools appears to be his chief biological characteristic, for considered functionally they are detachable extensions of the forelimb. (Oakley, 1975, p. 1.)

Evolutionary advance, however, alienated men from other animals. Anatomically, man was built neither to match the speed nor the strength of other animals. He did not possess even their sharp aggressive appendages and, therefore, had to depend entirely on his cunning for survival.

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Fossil records prepared on the basis of data collected by archaeological and anthropological expeditions, specially in Africa, suggest that around 2.5 Myrs ago there were plausibly at least three hominid lineages, all evolved from an *A. Afarensis* ancestors. One line came from *A. africanus* to *A. Robustus* in Southern Africa, another from the 'black skull' (*A. aethiopicus)* to *A. boisei* in East Africa and the *Homo* line leading to *H. habilis* and *H. errectus* in both north, east and south Africa. The earliest *Homo* grade is that of *H. habilis* and dates from 2.3-2.4 Myrs ago from members E and F of the Shungura Formation in the Omo Valley with more complete remains dating from 1.8-2.0 Myrs from the Olduvai Gorge and Koobi Fora in East Turkana and Sterkfonties member 5 in South Africa (Leakey, 1971; Phillipson, 1985). This is the first hominid to show an enlarged brain, best seen in the ER-1470 cranium from Koobi Fora, and it is highly significant that it is associated with the oldest evidence of stone tool manufacture. Moving back prior to 2.5 Myrs ago we have evidences of hominid foot-prints discovered at Laetolilin N. Africa. If we accept them as footprints of hominids they indicate a creature no more then 1.2 m tall which was bipedal although the free striding gait of modern man had not yet been reached. Above all, the form of locomotion suggest that running and moving at high speed may have been difficult and it is surprising that those small creatures survived the numerous predators, particularly since they do not appear to have reached the stage of tool making bipedalism. However, it would have allowed the hand (fore limbs) to be used for carrying missiles or a piece of wood for defense.

Huxley (1923) and Jerison (1976) suggested that more intelligent variants will succeed better in life and reproduction than less intelligent ones. This line of explanation supposes that tool-making and tool-using conferred adaptive advantages on larger brained mutants with greater ability for technology. These abilities involved brain enlargement and, subsequently, an enlarged brain showed improved mental abilities in other directions as well, permitting the development also of language and culture. Is this the reason why man among primates evolved and developed faster? If it is the case then, what was the adaptive importance of the tool? Why did they not become an equally important part of the adaptation of an incipient tool user such as the chimpanzee? Do we really know that any early hominids were intensive hunters? Does this equation mean that other hominid lineages did not hunt at all? Why have primates like chimpanzees and baboons, which are also known to hunt, not experienced equivalent selection pressure for an accelerated rate of brain size enlargement? Might it not be the case that the highly effective human hunting patterns recorded in ethnography from all around the world were possible only as consequences of technology, culture and an enlarged brain? That is to say, it is possible that hunting has been a consequence rather then a cause of evolutionary change. These were some of the questions raised by Isaac (1980).

Generally, scholars believe that man made tools for hunting and got success because of increased cranial capacity or intelligence (Dart, 1953, Washburn and Lancester, 1968). But if we analyse these questions keeping in perspective the differences in anatomy, brain and dentition between man and animals and variations in archaeological records in given time and space, then perhaps we may begin to work out some of these puzzling problems.

A comparative study of animals with the probable ancestors of man shows that man's ancestors should have been omnivorous and scavengers while the animals, on the basis of diet habits, are divisible into two broad groups, carnivores and herbivores. The salient differences between carnivorous and herbivorous animals is the absence of horns or antlers among the former type and the absence of long canines and claws among the latter. Both these types of built-in body equipment, natural tools, are absent in the case of man. Carnivores acquire food with the help of forelimbs, neck, jaws and teeth while in the case of herbivores the forelimbs hardly play any important role in the acquisition of food. If our ancestors' subsistence was based on vegetal diet alone then he would not have any difficulties in getting food, and would

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have behaved as chimpanzee do, for the latter is close to *A. africanus* in terms of cranial capacity. But if meat had been a part of their diet, then they would have faced two difficult problems: (a) How to kill animals? (b) How to process the kill for eating?

If man were a scavenger, his primary need, food to satisfy hunger, could have been acquired without making tools above the level those of chimpanzees. But his second need, security, would have posed a great problem for him because he is neither provided with any biological equipment, i.e., natural tools, nor is he a fast runner. *Therefore, plausibly, his first need is means to defend himself and his children* (Sinha, 1994).

Being a little more intelligent than the chimpanzee and other higher primates because of his developed cerebrum with more associated areas around sensory regions, he would have been probably constantly observing and watching natural phenomena such as the falling of boulders, the hunting of prey by carnivores and fights among animals. And, more likely, he might have noticed that objects like long canine teeth, horns, claws and antlers play a significant and effective role both in the self-defence of and the killing of animals, as well as in processing the kill; jaws and teeth play an important role in tearing off flesh from bones. He himself well have felt pain due to the accidental touch of a thorn or spines or had a miraculous escape from being killed but nevertheless being injured by animals' teeth and or claws.

Since man was not provided with such jaws and teeth and weapons like canine teeth, claws, horns, antlers, etc., he might have begun to think of how to get or replicate such natural tools for both defence, attack and the processing of food. To start with he would select and collect naturally pointed wood, shedded antlers, horns of dead animals, and stones to defend himself and his children. But such pieces, except stones, would not have been available everywhere and at any time, which perhaps forced him to replicate them on the medium most easily available – stone. This suggest that *he made artifacts on stone, firstly to protect and defend, and not for hunting* (Sinha, 1994). This is also supported, to some extent, by the fact that killing animals not only required hunting tools but also confidence that hunting equipments are sufficient enough to kill animals.

Archaeological data recovered from Africa show that man made tools like choppers and flakes first. When we look at chopper/chopping tools we notice that at least one ridge (point?) was made, which might have been simply a replication of teeth (canine?) or horn and/or antler to defend oneself and tear off the flesh of dead animals (scavenger). In the subsequent period, all efforts were directed towards making a pointed object (handaxe?) having better penetrating power as revealed in Olduvai Gorge where from the earliest deposit, tools like choppers and flakes were recovered, followed, in subsequent layers, by proto-handaxe, choppers and flakes; hand-axe, chopper and flakes; and hand-axe, cleaver, chopper and flakes, respectively.

After succeeding in fashioning pointed tools like the hand-axe, he proceeded to their refinement, i.e. from s-twisted lateral edge to straight lateral edge, irregular cross-section to uniform/circular/triangular/biconvex cross-section and thicker to thinner tools because he had probably noticed that a pointed but thick tool having irregular cross-section and s-twisted lateral edges did not penetrate deep into the body of an animal which, ultimately, reduced the frequency of success in hunting as well as in self-defence.

By the time of the Upper Acheulian culture, our ancestors were adept both in self-defence and hunting and had time to further improve their lithic techniques.

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PREHISTORIC TECHNIQUES: Basic and Specialized

It is difficult to describe precisely how man started making lithic tools. Indeed, the idea of making/flaking stone pieces might well have come to him due to interaction with the environment and learning through observation about happenings in the surroundings. He might have observed that when a stone boulder/block fell to the ground from a height it often got broken when it landed on hard rock or another boulder. He might also have observed that when he threw a stone at an animal and his missile missed the mark and, instead, struck another hard material it often gets broken. When he looked at the chipped pieces he might have noticed that they usually have sharp lateral edges, which are good to cut meat or plants. These are some of the possibilities which could have played an instrumental role in giving man the idea of breaking stones to produce tools.

A number of scholars have replicated many techniques by flint-knapping experiments. Mention many be made of Burkitt (1944, 1963), Baden-Powell (1949), Leakey (1950), Sankalia (1964), Crabtree (1966, 1968, 1970, 1972), Crabtree and Swanson (1968), Bordes (1969), Bordes and Crabtree (1969), Crabtree and Gould (1970), Newcomer (1970, 1971, 1975, 1976), Jelinek, et al. (1971), Pant (1973), Oakley (1975), Clark (1980), Pant and Agarwal (1980), Sinha (1980, 1984, 1986, 1991), Owen (1982, 1984). Moreover, scholars such as Crabtree and Butler (1964), Rinehart (1964, 1966), Cotterell (1968, 1970, 1972), Faulkner (1972) and Speth (1972, 1974) also tried to study the mechanics of stone fracture. The findings of these and other researches may be summarized here.

Lithic technology, like other crafts, is a combination of two factors. The first is the method, i.e. the use of the mind, and the second is technique, i.e. the use of the hand. Experiments and ethno-archaeological data have demonstrated that there are primarily two techniques, percussion and pressure. But prior to getting down to making any tool or artifact, its morphological features and the technique that can be adopted to shape them must be conceived in the mind, otherwise, one would not be able to make the desired tool type or artifact. Thus, before making something, there is present in the mind, the shape of the tool and the technique to be adopted. Therefore, if one is making a particular tool type it means that one wants to use the tool for some particular end (Sinha, 1991).

In the percussion technique either the object or the hammer is in motion; in the pressure technique neither is in motion (Figs. 6-9). However, in archaeological literature a number of techniques have been mentioned such as anvil technique, free hand-held technique, bipolar technique, inverse technique, clactonian technique, levalloisian technique, mousterian technique, grinding technique, fluted core technique, micro-bruin technique, flake-cleaver technique, etc. All these are innovations and improvisations on basic tool techniques. Besides technique *per se*, other factors also play a significant role in fabricating tools, such as the types of manufacturing tools, the raw material, and the degree of skill with which the fabricator can coordinate hand, fingers, thumb and brain. Man had been perfecting his technology through experience, empirical knowledge. When he noticed that the stone hammer created deep scars because of pointed impact he changed to antler/wood/bone hammers. With the help of such types of tools, commonly known as soft hammers in archaeological literature, he started getting diffused scars on the flakes and fabricated tools which ultimately helped him to fabricate still finer artifacts with nearly straight working edges.

The percussion technique requires a fabricator or hammer which can impart sufficient force to exceed the elastic limits of the stone and cause fracture. The application of the percussion technique can be executed by both types of hammers, hard and soft. The hard or soft hammer controls the interval of contact. If the hammer is of antler, wood or bone (soft hammers) then the interval of contact is prolonged while with the stone hammer

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(hard hammer) it is shortened. Relatively, soft hammers contact a larger area than hard hammers. This causes the cone of force to have a larger truncation and the flakes to have a diffused bulb of percussion (Fig. 10). Percussion technique can be of either the hard hammer or the soft hammer type. All of the diverse variations of this technique will probably never be known, but it prevailed during the entire Stone Age until metal implements became common. However, one of the most important variants of this technique is known as the *indirect percussion technique* or *punch technique* (Figs. 7 and 8). In this technique, a punch is placed on a well-prepared platform of a core and the hammer imparts the force through a punch, hence indirectly. Because of this variant, the former percussion technique is usually referred to as *direct percussion technique* (Fig. 6). Indirect percussion technique is more accurate than direct percussion and detaches straighter and more uniform flakes and blades with small platforms. The *punch* is a semi-pointed or blunt rod-like object of tenacious stone, bone, antler, horn, ivory or hard wood. For good results, two persons are required for working the punch technique, one to hold the stone tool or core and the other to hold the punch and deliver the blow. However, the maker can also hold the working object between his feet leaving his hands free for holding the punch by one hand and give the blow by the other.

In the pressure technique, blades/flakes can be removed from a core by using the chest or shoulder crutch or a staff held in both hands (Fig. 9a). The main feature which distinguished the pressure technique from the percussion and especially from the indirect percussion technique is that the hammer remained in direct contact with the stone core or flake and was pressed hard till a narrow blade or flake was detached. Thus a constant force for a longer duration was involved in this case in contrast to the swings of the hammer in the percussion technique. Generally, pressure flakes/blades are small and thin as compared to those made by percussion or indirect percussion techniques. For obvious reasons, this technique would have been used more in making tools through retouching and backing techniques (Fig. 9b) than in manufacturing blades/flakes.

Levalloisian Technique

This technique was first noticed at Levallois Perret, a suburb of Paris, France, hence its name. Levallois flakes are different types of flakes detached from a prepared core. Beginning with the rough trimming of the sides of the core, the technique involved knocking off upper surface flakes in such a manner that the flakes scars usually meet in the centre, centripetal flakes (Fig. 11a). Thus, obtaining a surface which resembles, broadly, the back of a tortoise. A striking platform is prepared at one end, either by small facets or by a big flake, this being almost perpendicular to the flattened plane of the core. A blow struck with a stone hammer on this platform determines a flake surface which cuts again the surface of the first centripetal flakes of the preparation and gives an oval flake, having nearly the form of the core and presents on the upper surface the traces of the centripetal flakes of the preparation. The cores dressed for the detachment of Levalloisian flakes are called *tortoise cores* because of their vague similarly with the back of a tortoise.

Flake-cleaver Technique

Flake-cleavers are those cleavers which are made on flakes, with or without a transverse blow forming the cleaver edge. In India, most of the flake-cleavers are without transverse blows forming the cleaver edge. (Fig. 11b). Through this technique flake-cleavers are made by the intersection of the distal portion of the flake scar(s) of earlier removed flake(s) and the primary flake surface of the flake-cleaver (Sinha, 1984).

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Mousterian Technique

This technique derived its name from the site of Le Moustier, France. It is comparable with the Levalloisian technique and is also known as the *discoid core technique.* For this technique man must have selected either large flakes with a flat surface on one side or a pebble/nodule with at least one side flat. Continuous blows were struck in removing centripetal flakes, sometimes alternately on both the faces of the core. The final product is a discoidal core (Fig. 12a).

Fluted Core Technique

This techniques was applied in making blades. Under this technique, the core is generally cylindrical, with one end slightly tapering. The core is prepared first to produce a single ridge, crested-guided-ridge, by alternately flaking along the length of the core (Fig. 12b). Thereafter, an oblique stroke is imparted through a punch on the ridge. After the removal of this ridged blade, two ridges form on the core representing the negative scar of the blade on the core. These ridges are used again to produce blades and the repetition of this process creates a number of ridges and furrows on the core. This is why this technique is called the fluted core technique.

Backing Technique

The intentional dulling of one margin of a flake or blade by detaching a series of flakes at right angles from the lateral margin opposite the sharp edge or the edge to be used (Figs. 9b and 12c) is termed *backing.* In some instances, prehistoric man took advantages of natural backing, such as cortex, to serve as the same dulling medium right from the Lower Palaeolithic period in making tools like knives.

Micro-burin Technique

This is a method of serving blades to make geometrical microliths. The technique requires first weakening the blade by marginal notching and then breaking it at the notch (Fig. 12d).

LITHIC TECHNOLOGY:
Turning Points and Consequences

Nearly 99.5 per cent of the history of man's activity falls in the period known as the Stone Age, the period when man was not aware of any kind of metal or, even if he was, he was not making or using metals to manufacture tools, weapons and/or other kinds of artifacts. How Stone Age man fabricated artifacts in stone and other materials we have already discussed above. It is now necessary to examine whether there had been changes and innovations in his lithic technology and methodology right from the beginning to nearly the end of his making of stone tools. These are some of the primary questions that need to be discussed if we are to understand and interpret the culture, science and philosophy of those who were our earliest ancestors and makers of tools, weapons and other objects not only on stones but on bones, antlers, terra-cotta, etc. as well. The study of the evolution of stone tools in particular becomes most significant in the light of the fact that 99.5 percent of the history of man is documented and reflected by stone artifacts. Organic materials being perishable, stone artifacts become the primary fossil records and source of inferences concerning man's activities and behaviour, which constitute the elements of cultures and tradition. Stone tools and other associated artifacts are thus the only source of information the earliest and incipient, though primitive, state of science, culture and philosophy.

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So, let us begin with the assumption that ultimately, somehow, prehistoric man learnt to split stone boulders, cobbles and nodules with the help of another stone, the hammer. Prehistoric man was primarily interested in fabricating tools having either pointed ends/ ridges or sharp cutting edges, e.g., chopper/chopping tools and flakes (Sinha, 1994). Gradually, in course of time and over space, when he became a master in controlling his strokes on the core; he visualized and practiced the effect of the varying impact of his blows; he began to produce the particular shapes that we usually identify as proto-handaxes or handaxes. Initially, our ancestors made tools on pebbles and chunks, later, in course of time, they realized that if they made tools on flakes instead of pebbles and chunks it would reduce the thickness of the tool as well as shorten the time required for thinning artifacts. Technically speaking, they were applying the direct percussion technique with a hard hammer but they failed to improve and control the lateral edges and cross-sections because of deep scars usually created by hard hammers (Figs. 6 and 10). Perhaps, he failed to develop the perfect coordination between techniques and methods, what was achieved in the Second Stage. Because of this, his First Stage (within the Lower Palaeolithic period) tools are commonly crudely made, lacking perfect profile, point and straight sharp edge and most of them are unifacially retouched.

Till that time he had been using only one plane of the chunks or cores or even of flakes because he had not experienced the advantage of using both planes as was done in the Second Stage. Moreover, his familiarity with different types of stone raw material was very limited. He had not yet experimented with other raw materials, as is documented in the assemblages recovered from the earliest levels in various parts of the world like the Olduvai Gorge – Oldwan Level and Koobi Flora, and the KBS Level in Africa. He exploited only those rocks which were available in abundance and of larger dimensions in their respective regions. In spite of the fact that he had begun to manufacture tools, his primary objective had not been accomplished, namely, fabricate and replicate a tool which can easily and successfully penetrate into animal bodies. His trial and error experiments, therefore, continued in the Second Stage. Later, during the time of the Second Stage, he might have experienced that if he used only one plane to give shape to any stone piece he failed to perfect the desired shape of the tool such as a convergent edge tool/pointed tool or a straight cutting edge tool. The reason behind this failure lies in the differences between the unifacial and bifacial retouching techniques and the resultant effect which can be demonstrated through experiments (Fig. 13). In the case of unifacial flaking or retouching, hammer strokes are applied on only one plane, either on the dorsal or the ventral surface. In the case of bifacial flaking, both the surfaces are alternately struck to remove flakes. In the case of the former technique, such strokes lead to the recession of the lateral edges or outer profile towards the principal axis of the stone piece and reduce the width of the tool and increase its thickness. So, whenever he tried to make a finer straight or convergent edge or pointed tools using a single plane only, i.e. using the unifacial technique, he failed to get the desired shape and efficiency (Fig. 13).

As stated earlier, the only boon man got from nature was his developed or developing brain and cranial nervous system. With the aid of this tool he had been constantly and regularly observing and storing knowledge of the effect of his strokes and the nature and style of stone fracturing mechanics but without any scientific understanding of what was happening. Stored empirical knowledge and experiences suggested to him that, instead of striking only one plane, strikes are made alternately on both planes (the bifacial technique), the dorsal and the ventral, he could control the profile, edge, thickness and width of the tool. He thus started getting nearly the desired shape of the tools. The adoption of the bifacial techniques ushered in the Second Stage of the Lower Palaeolithic period (Fig. 13).

Realizing the substantial advantages in using both the faces alternately, man in the Second Stage of the Lower Palaeolithic period began to get preliminary success in making

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S-twisted cutting edges as well as convergent or a nearly pointed edge with the help of the hard hammers. Perhaps, this experience prompted them to develop other improved methods of making tools and to look for other possibly better fabricating tools. Thus, they were inspired to carry on more experiments to evolve and develop new methods and techniques with the confidence that whatever they had achieved so far was not the end. Such conceptualization would have played a significant role in the development of their culture through developing new ways of thought, customs and traditions; one method, one means and one source were not the absolute and eternal; the possibility of change, of progress was beginning to be recognized.

In those parts of the world, like India, where Second Stage tools were primarily made on quartz, quartzite and basalt types of raw materials, the makers developed a new technique to make cleavers, because on such raw materials they encountered difficulties in getting a cleaver edge through a single transverse blow. In India, cleavers were mostly made on flakes and their cleaver or working edges seldom suggest the application of a single transfer blow (cf. Bordes, 1966). At least Indian cleavers which are made on flakes were most probably made by the flake-cleaver technique (Fig. 11b). The truth of the old saying, 'Necessity is the mother of all invention,' is well reflected here and this technique was probably the first step in the development of specialized techniques and planning.

In the Second Stage, men were making tools with a hard hammer using the bifacial percussion technique and were experimenting with other possible hammers. Their new experiments showed that when they used a hard hammer, they were getting deep scars on the fabricated tools. Because of these deep scars, these were not achieving the desired straight angular edges, but when they adopted other types of hammers, like those made of antler, wood, or long broad bones of big animals, they began to get narrow, flattened, shallow scars. This discovery helped them a lot in giving their tools the desired shape and efficiency.

The introduction of new types of fabricating tools made of antler, bone or wood, commonly called soft hammers, marked the beginning of the Third Stage within the Lower Palaeolithic period. Through a long period of experimentation and interaction with the hard hammer and bifacial technique, they found that the major hurdle in getting straight or convergent angular edges were deep scars. Perhaps, it came to their mind that the heaviness of the hard hammer causes such deep scars, so started experiments with light-weight *stone* hammers. Obviously, to get a light-weight stone hammer which can be gripped in the hand properly they started selecting such pebble stones which were rounded, broad, thin and flat. After getting some preliminary success in reducing the depth of the scars, they began to experiment with non-lithic hammers having similar morphological features and light-weight such as wood, bone and antler.

Although, they had succeeded in controlling the depth of the scars and edge profiles in the course of experimentation and practice, they were obviously unable to understand the physics or mechanics behind such effects. However, the experiments and experiences had taught them that when they applied a relatively heavy stone as a hammer prominent positive or negative bulbs of scars, cones and often, lips were produced on the stone pieces. This must have been the main problem they had to face in refining their tools, irrespective of their primary forms – chunks, cores or flakes. Therefore, their main concern was to get a diffused bulb of percussion, both positive and negative, and they achieved this by using soft hammers. In the course of time, they started using both hard and soft hammers in making a single tool. They started with using a hard hammer to trim and to draw out the line of the desired tool type and then, in the second and/or final stage of its making, they changed to the use of a soft hammer, to get the desired working edge. The scientific reason behind this is the fact that, in the case of hard hammers, the area of contact between the hammer and the object is very small and, hence, the force of the impact is concentrated at

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the point of impact, while in the case of soft hammers, the contact area increases and there is relatively less force spread over a larger area (Fig. 10).

In those parts of the world where quartz, quartzite and basalt were used, as in India or Africa, prehistoric man also realized that, inspite of their best efforts, they were unable to manufacture tools of the desired narrow cross-section and having piercing, long and sturdy tapering or converging pointed ends. Perhaps, this prompted them to look for other raw materials to get the desired results. They began to smash and test all naturally available rocks. In this process they would have come across cryptocrystaline rocks like chert, chalcedony, agate, carnelian, etc. The required size of the raw material, except in the case of chert, was perhaps not naturally available, and they therefore selected chert alone. Chert is a fine-grained rock, definitely better for tool making than the earlier used raw materials. Therefore, wherever ancient man encountered cherts he preferred to make tools on them which enhanced the quality and efficiency of the tools available. However, chert was not imported by regions lacking in deposits of their own.

Control over the combined use of both types of fabricators and selection of raw materials brought several changes in tool types. Some new tool types were introduced, such as a greater variety of handaxes and cleavers, spheroids, discoids, knives, etc., and highly refined and efficient tools having regular angular profile of the edges instead of *S*-twisted edges. This must have raised the importance if not the status of those who had acquired expertise in using combined fabricators and must also have brought stylistic if not functional variations in their tool kits. Similarly, some of them must have become experts in using such refined tools, especially in the prevailing subsistence economy. Perhaps, at least because of these two factors, specialist groups must have emerged in society by the end of the Third Stage. Hence, innovations in technology and its proper and systematic or chance applications must have began to play a key role in the further development of human behaviour, customs, traditions and culture. This fact is documented by the findings of new techniques, such as the Levalloisian (Fig. 11a), which are nothing but improvements on basic methods and techniques. The introduction of the Levalloisian technique marked the beginning of the Fourth Stage (within the Lower Palaeolithic period).

By-products of the bifacial technique include typical, flattened, thin, wing-shaped flakes, commonly referred to as biface-trimming flakes. The study of these flakes demonstrates the usual steps involved in making bifaces like handaxes, cleavers, knives, etc. (Newcomer, 1971). This would have provided them an inspiration to produce flakes whose shapes and working edge were pre-determined by careful preparation of the parent core (Fig. 11a). Such flake tools are Levalloisian flakes, Levalloisian points, etc. and the technique is known as Levalloisian technique. This technique further reduced the thickness and size of the flake tools.

Differences in traditions and human behaviour are well represented in the assemblages recovered from various regions of the world (Sankalia, 1974; Clark, 1977; Bellwood, 1978; Phillipson, 1985; Gamble, 1986; Sinha, 1986; Clark and Sharma, 1983a, 1983b). The Levalloisian technique was not commonly adopted and practiced in each and every region of the world (Fig. 14). In India, only from a few sites have such tools been reported as were made by true Levalloisian technique (Misra, 1975-76). Most of the other reported Levalloisian tools are really pseudo-Levalloisian in the technical sense (Jayaswal, 1978; Clark and Sharma, 1983a, 1983b). In India, assemblages consisting of Levalloisian tools generally belong to the Late Acheulian tradition/period. However, this technique suggests that by this time prehistoric man had developed the idea of planning, the ability to foresee probable outcome of present action and the significance of living in groups, which is usually required in hunting expeditions. Because of such conceptualizations, the onward journey of prehistoric man and his economic technology could now change faster.

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The Upper Pleistocene fossil record indicates that by this time the environment had changed considerably. A number of small and fast-running animals and different types of forests had arrived on the scene. Human population had spread to almost all parts of the 'Old World'. Therefore, human beings had to modify and develop their techniques and tool kits to cope with prevailing situations. Behavioral difference further increased. The appearance of fast-running animals compelled man to increase his catchment area and to develop such types of hunting gear as could be carried easily while chasing animals. The earlier heavy and bigger tools were now found inconvenient. Hence, they started making tools on small detached flakes and very nearly abandoned bifacial tools like handaxes, cleavers, etc. If they did make bifaces, they were of smaller dimensions which are usually called miniature handaxes and cleavers. Since the weight of stone tools could only be cut down by reducing the dimension of the stone pieces on which tools had to be prepared, they began to manufacture tools on small flakes which also helped them in increasing the efficiency of the tools, being thin and flat on one face, the ventral face. This was the beginning of the Fifth Stage (Middle Palaeolithic Period).

In place of biface tools, the thrust had shifted to various types of scrapers and points. In Europe, to prepare tools on flakes during this period, they developed a technique known as the Mousterian core technique (Fig. 12a). Like the Levalloisian technique, Mousterian technique too failed to become an essential technique to replicate flakes in India (Fig. 14). Above all, inventories of tool types reported from different parts of India also reveal that all varieties of tools like various types of scrapers and points, as reported from western countries, have not been encountered in India as well as in other parts of the world (Sankalia, 1974; Clark, 1977; Bellwood, 1978; Phillipson, 1985; Gamble, 1986; Sinha, 1986; Clark and Sharma, 1983a, 1983b). Although scholars in India have reported points, they could be better classified as convergent scrapers (Clark and Sharma, 1983a). All these differences indeed demonstrate behavioural/cultural variants on a world wide scale. Do such a wide differences in various parts of the world suggest the hands of a variety of sub-species of modern man, *Homo sapiens*, in different parts of the world? Recent researches have pushed back the antiquity of modern man to 200,000 years ago (Clark, 1994).

Use-wear analysis carried out on scrapers reveals that most of them were used for scraping wood and hide. Also, the frequency of scrapers predominates in the tool kits of the period. These two factors suggest that the Fifth Stage people were definitely making tools and other objects on wood and might have been using skin and hair in manufacturing objects like thread, leather containers, and, with the help of latex, cloth, etc. Due to their perishable character, we fail to encounter them in the excavations. If this was the case, then they would have probably started covering their body, at least the lower part. By this time they had acquired knowledge of fire making. They would have used fire to burn wood soaked in animal fat for illumination and to manufacture wooden artifacts.

At least from the transitional period between the Fourth and Fifth Stages, man had been occupying rock-shelters and caves. Control over fire made them comfortable not only by defending them against wild animals and keeping them warm, but also by making it possible for them to live in rock-shelters and caves. Prior to this transitional phase they commonly inhabited foothills which would provide them with enough space to run to safety in case of an emergency. This would not have been possible when cooped in the rock-shelters and caves. Further development of the idea of living in groups and with a sense of after-life is very well documented by the discovery of two burials in France. However, no such discovery has been made so far in India.

During the last phase of the Fifth Stage human beings had begun to make elongated or longer flakes which have been generally referred to in archaeological literature as flake-blades. A close scrutiny of these flakes reveals that most of them bear a ridge on their dorsal

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face. Further development and innovations in prehistoric lithic technology is in fact improving the technique for producing ridges and, thereafter, for exploiting them to manufacture long, parallel-sided flakes, i.e. blades, which was ultimately achieved after a number of experiments and exercises. This technique is known as the Fluted Core technique (Fig. 12b). With the introduction of this technique we enter into the Sixth Stage (Upper Palaeolithic).

The introduction of the bow and arrow led man to manufacture such types of tools as could be used as arrow-heads and barbs. Since hitting the target using a bow and arrow requires a well-balanced arrowhead to move in a particular projectile trajectory, improving the balance of the arrowhead had been the primary interest of Sixth Stage man. This goal was accomplished by the invention of the fluted core technique. Man was now able to fabricate tools having parallel sides and lengths twice or more times their width. To prepare blades from fluted cores, man used both percussion techniques of direct and indirect, and of pressure, which involved coordination not only between hands but also with the legs and/or understanding between two collaborators (Fig. 7-9).

It seems that the idea of using bows and arrows would have originated in the last phase of the Fifth Stage which is the reason why the people of that phase had begun to fabricate flake-blades, though they did not meet with great success. There is ample evidence that, before preparing fluted cores, they were pre-heating the cobbles, pebbles and/or nodules of cryptocrystaline rocks. Experiences had probably taught them that it was easier to chip off long blades from heat-treated cryptocrystaline rocks. The scientific reason lies in the fact that heating evaporates moisture present inside the cobbles/pebbles and this renders the cortex a little brittle.

Besides manufacturing blades, Sixth Stage man also started blunting (backing) one or two edges of the blades to enable their proper handling either in hafts (handles) made of wood, bone or antler, or free-hand. Because they had noticed that the sharpness of the lateral edge of the blades inserted and fixed by latex into the groove made on hafts/handles always posed the risk of their cutting into and getting imbedded in the handle when force was applied to cut anything with the other sharp edge of the blade, ultimately leading to the loosening of the inserted blades, and that, similarly, the un-hafted, sharp lateral edge cuts the fingers of the user, they began to blunt the unnecessarily sharp edges by removing a series of small flakes at right angle from the edge(s) of the blade which they wanted to blunt. This technique is commonly called backing or blunting technique (Fig. 12c) and in this technique, either they used direct/indirect percussion or pressure, preferring the latter. For freehand use, they would either have blunted the lateral edge or would have pasted a thick coat of latex on the edge in contact with the finger(s).

Introduction of backing technique during the Sixth Stage further demonstrates that man had acquired the knowledge and skill required to give any desired shape to their blades produced by fluted core technique. This facilitated the hafting of their tools in wooden or antler handles to produce composite tools such as knives, saws, harpoons, etc. Preparation of harpoons is attested by the recovery of these weapons made on bone and antlers. With knowledge of backing technique, it was possible to truncate the blade proper. Further attempts were made to reduce the thickness and width of the tools, which resulted in the production of baldelets. Well equipped hunting gear of the time enabled man to save his time and energy and to think not only of his subsistence, but also of other things. This fact is attested to by his rock paintings, sculptures and the recovery of probable shrines to the mother goddess.

In India, however, tools like harpoons and other objects made on bones, antlers, stone, terra-cotta, wood, etc., are very rare. Only one object made on bone and one on ostrich eggshell have been reported so far from Lohanda Nala, Belan Valley, Allahabad District (Sharma, 1980) and Patne, Maharashtra, respectively. The former object has been identified

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as a Mother Goddess by Sharma while Gupta (1979-80) preferred to identify it as a harpoon. Being the only discovery of its kind, while we cannot precisely identify it as a Mother Goddess, it cannot be identified as a harpoon either for obvious reasons. Besides the negligible frequency of such objects, there is a sharp difference between the range of tools reported from other parts of the world and in India. In fact, as stated earlier, the differences and variations, which had begun from the Fourth Stage, further widened by this time. The Sixth Stage is not evenly present in all parts of the Old World (Phillipson, 1985; Sinha and Glover, 1984; Bellwood, 1978). It is not present, for example in South Africa, East Africa and the mainland of Southeast Asia (Fig. 14). Tools like the Solutrean points, Magdalenian points, Laurel Leaf points and other typical artifacts are very common in the European Sixth Stage (Collins, 1986). Does this reflect the development of indigenous traditions, cultures and human behaviour and/or dietary habits? Does it suggest that India's inhabitants were not interested in superficial stylistic variations, only in functional aspects and simple living and/or were not so innovative as were the inhabitants of Europe from the transitional phase between the Fourth Stage (late Acheulian tradition or late Lower Palaeolithic) and the Fifth Stage (Mousterian tradition or Middle Palaeolithic)?

Use-wear analysis carried out in India on late Upper Palaeolithic (last phase of the Sixth Stage) and Mesolithic stone tools (Seventh Stage) suggests that here subsistence gathering activities predominated (Sinha, 1986, 1989) while in the case of Europe hunting activities predominate (Moss and Newcomer, 1982; Moss, 1983). Does this suggest that Indians have been primarily vegetarian since the Sixth Stage and the Europeans non-vegetarian? Indeed, the results of such limited use-wear analysis should not be generalized, even though providing some clues for future researches in this direction.

Lithic technology of the Sixth Stage also throw a welcome light on one more important aspect of life. The selection of the raw material which had begun in the Third Stage became so important that only cryptocrystaline rocks were now being used whether available in the catchment area or not. And only in very rare circumstances was there compromise on this aspect. This fact is very well represented in the case of the Belan, Tons and middle Son valleys and the Middle Ganga plains. In these regions, explorations carried out by the present author suggest that cryptocrystaline rocks are only available in the beds of the Middle Son valley and that is why inhabitants of the valley had begun manufacturing tools on chert from the Third /Fourth Stage while in the case of the Belan and Tons valleys they started making tools on chert and other cryptocrystaline rocks only from the Sixth Stage and, in the case of Middle Ganga plains, from the Seventh Stage, when it became nearly essential to get perfect blades by using the fluted core technique. Therefore, it seems that some members of the group(s) were given the responsibility to explore the area and collect cobbles/pebbles of cryptocrystaline rock. Perhaps such activities later developed into a barter kind of trading.

However, it seems that, in spite of all his efforts to improve hunting equipment, man at this stage could not reach the level of cent per cent success in hunting expeditions. Besides this factor, demographic pressure too compelled him to gear up his gathering equipment. He had experienced that long blades hardly fit properly in rounded handles made of wood or antler, such as those used to prepare sickles and other rounded composite tools. The explanation lies in their geometry. When a circle is divided into smaller and smaller arcs, the arc comes closer to being a straight line; longer segments retain their circular character (Fig. 15). While not familiar with such mathematical reasoning, people then had empirical knowledge about such hurdles and how to overcome them. Therefore, to meet their requirements, they first cut down the length of blades by reducing the size of cores. Such blades are commonly known as microliths. While the production of microlithic blades had begun from the last phase of Sixth Stage, they predominated in tool kits only from the Seventh Stage, the Mesolithic Period. Since the preferences shifted from hunting to gathering, people

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started living at one place for relatively longer durations. This factor of longer stay perhaps played a leading role in domestication of animals, cultivation and the invention of ceramics. Since for subsistence people still relied on gathering, they started thinking of reducing the time usually involved in processing vegetal material, which is attested by the appearance of querns and mullers.

To retouch tiny blades or microliths people modified and developed a new technique known as the Micro-Burin technique (Fig. 12d), since earlier techniques of retouching and making various types of tools on microliths were not found feasible. The inventory of tool types of this stage comprises both non-geometrical and geometrical tools. Geometrical tool types of this stage include lunate, triangles, trapezes, trapezoids, tranchets and rectangles. However, the fabrication of some of the geometrical tools like lunate and triangles had already begun in the last phase of the Sixth Stage but had not at that time become a regular component of tool kits. The reduction in size of the tools, the microliths, would be compensated for by poisoning the tips of arrow heads and fishing gear.

The introduction of domestication and cultivation marked the beginning of the Eighth Stage, the Neolithic Period which gave rise to another challenge, the challenge of creating and searching for suitable areas (fields) for cultivation. Most likely, to meet this challenge, man began to fabricate polished tools, usually known as neoliths, for deforestation. They had learned the importance and significance of ridges in flaking. They had also noticed that the resultant effect of strokes on the ridges, whether made intentionally (fluted core technique) or accidentally or in use always removed flakes. Therefore, after giving shapes to the stone pieces by the percussion technique, which produces ridges on the faces of stone piece, they began to remove such ridges on tools through pecking and grinding (Fig. 16) so that they might not be damaged when cutting plants and trees.

INDIAN ELEMENTS IN PREHISTORIC CULTURES

In view of the widespread adoption of lithic technology, it is hard to identify what is peculiar to Indian prehistoric technique. However, if we can retrieve data on lithic techniques, tool types and functional aspects of tools, about learned and shared patterns of behaviour, the thinking and feeling of their makers in time and space, we may find some clues to inferring cultural traditions. However, it would not be out of place to mention here that archaeological data show that there had been variations in composition of lithic assemblages, not only in terms of frequency distribution but also in techniques applied, e.g., in the Indian context typical Levalloisian or Mousterian techniques are conspicuous by their absence, only pseudo-Levalloisian or pseudo-Mousterian techniques are present. This probably suggests differences between prehistoric cultures reported from other parts of the world. This variability increased in time and space. Such variations may be the result of behavioral differences, stylistic, functional and/or technological.

If we can recollect data on these factors with the help of a dialogue with stone tools, tool making and functional analysis of stone tools, perhaps we would be able to identify feelings, thoughts and behavioral attitudes of prehistoric man. A synthesis of such data would probably help us to identify Indian prehistoric culture and distinguish it from what is alien.

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APPENDIX

List of Some Important Stone Age Sites in India (Figs. 1-5)

Name of Site	*District*	*State*
Lower Palaeolithic Sites		
Adamgarh	Hoshangabad	Madhya Pradesh
Agar	Shahajapur	Madhya Pradesh
Anagawadi	Anagawadi	Karnataka
Astajuri	Midnapur	West Bengal
Attirampakkam	Chingelpet	Tamil Nadu
Baddi	Ambala	Haryana
Bamandih	Midnapur	West Bengal
Barkhera	Raisen	Madhya Pradesh
Basawal	Ambala	Haryana
Belhata-II	Satna	Madhya Pradesh
Beli Diwwar	Ambala	Haryana
Bhedakui	Midnapur	West Bengal
Bhimbetka	Raisen	Madhya Pradesh
Bhud	Ambala	Haryana
Bilaspur	Kangra	Himachal Pradesh
Bori	Pune	Maharashtra
Chauntra	Rawalpindi	West Punjab (Pak.)
Chhatarpalia	Allahabad	Uttar Pradesh
Dahar	Kangra	Himachal Pradesh
Dehra	Kangra	Himachal Pradesh
Didwana	Nagaur	Rajasthan
Durkadi	Nimar	Madhya Pradesh
Gangapur	Nasik	Maharashtra
Gopipur	Kangra	Himachal Pradesh
Gudiyam	Chingelpet	Tamil Nadu
Guler	Kangra	Himachal Pradesh
Haripur	Ambala	Haryana
Hathnora	Hoshangabad	Madhya Pradesh
Hatwa-I	Sidhi	Madhya Pradesh
Hunsgi	Gulberga	Karnataka
Indola-Ki-Dhani	Nagaur	Rajasthan
Jawad	Mandsaur	Madhya Pradesh
Jayal	Nagaur	Rajasthan
Khora-Kachoa	Ambala	Haryana
Koskangarha	Allahabad	Uttar Pradesh
Lalitpur	Jhansi	Uttar Pradesh
Mahadev-Piparia	Hoshangabad	Madhya Pradesh
Malpur	Ambala	Haryana
Nakjharkurd	Sidhi	Madhya Pradesh
Nalgarh	Ambala	Haryana

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Name of Site	*District*	*State*
Naru Hill	Satna	Madhya Pradesh
Nayagrah	Midnapur	West Bengal
Nevasa-Chirki	Ahmednagar	Gujarat
Nittur	Bellary	Karnataka
Paisra	Monger	Bihar
Palasi	Ambala	Haryana
Patpara-I	Sidhi	Madhya Pradesh
Pirthan	Ambala	Haryana
Raisen	Raisen	Madhya Pradesh
Ramgarhwa	Allahabad	Uttar Pradesh
Rampur	Ambala	Haryana
Rampur	Mandsaur	Madhya Pradesh
Rampur-II	Satna	Madhya Pradesh
Renigunta	Chittoor	Andhra Pradesh
Sagatha	Satna	Madhya Pradesh
Sharada Temple-I	Satna	Madhya Pradesh
Sharada Temple-II	Satna	Madhya Pradesh
Sharada Temple-III	Satna	Madhya Pradesh
Sharada Temple-IV	Satna	Madhya Pradesh
Sihawal	Sidhi	Madhya Pradesh
Singhbhum	Singhbhum	Bihar
Singi-Talav	Nagaur	Rajasthan
Tikura	Satna	Madhya Pradesh
Middle Palaeolithic Sites		
Adamgarh	Hoshangabad	Madhya Pradesh
Bagalkot	Bagalkot	Karnataka
Bataubir	Allahabad	Uttar Pradesh
Bel Pandhari	Ahmednagar	Gujarat
Belhata-I	Satna	Madhya Pradesh
Bhimbetka	Raisen	Madhya Pradesh
Bijatala	Mayurbhanj	Orissa
Didwana	Nagaur	Rajasthan
Haragundgi	Gulberga	Karnataka
Harichandrapur	Dhenkanal	Orissa
Hatwa - II	Sidhi	Madhya Pradesh
Jagannathpur	Koenjhar	Orissa
Jawali	Gulberga	Karnataka
Kalegaon	Ahmednagar	Gujarat
Khandalia	Mayurbhanj	Orissa
Khandivli	Bombay	Maharashtra
Khutabir	Mirzapur	Uttar Pradesh
Koregaon	Pune	Maharashtra
Kovalli	Kovalli	Karnataka
Madhmeshwar	Ahmednagar	Maharashtra
Maheshwar	Maheshwar	Madhya Pradesh
Nandur	Ahmednagar	Gujarat
Nevasa on Pravara	Ahmednagar	Gujarat
Nevasa-Chirki	Ahmednagar	Gujarat

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Name of Site	*District*	*State*
Nittur	Bellary	Karnataka
Patpara	Sidhi	Madhya Pradesh
Ramla	Koenjhar	Orissa
Rampur-I	Satna	Madhya Pradesh
Renigunta	Chittoor	Andhra Pradesh
Ror	Kangra	Himachal Pradesh
Saipur-I	Satna	Madhya Pradesh
Sangankallu	Bellari	Karnataka
Sihawal	Sidhi	Madhya Pradesh
Sihora	Sagar	Madhya Pradesh
Sinaora	Satna	Madhya Pradesh
Singhbhum	Singhbhum	Bihar
Suregaon	Ahmednagar	Gujarat
Upper Palaeolithic Sites		
Baboora	Sidhi	Madhya Pradesh
Baghor-I	Sidhi	Madhya Pradesh
Baghor-III	Sidhi	Madhya Pradesh
Bamni	Mandla	Madhya Pradesh
Barudih	Singhbhum	Bihar
Benhatti	Gulberga	Karnataka
Bhadne	Dhulia	Madhya Pradesh
Bhimbetka	Raisen	Madhya Pradesh
Budha Pushkar	Alwar	Rajasthan
Dhanuhi	Rewa	Madhya Pradesh
Didwana	Nagaur	Rajasthan
Inamgaon	Pune	Maharashtra
Jogdah	Sidhi	Madhya Pradesh
Muchchatla Chintamanu-Gavi	Kurnool	Andhra Pradesh
Nagarjunakonda	Guntur	Andhra Pradesh
Nevasa-Chirki	Ahmednagar	Gujarat
Nimua	Satna	Madhya Pradesh
Nuia	Singhbhum	Bihar
Patne	Jalgaon	Maharashtra
Rampur	Sidhi	Madhya Pradesh
Renigunta	Chittoor	Andhra Pradesh
Saipur-III	Satna	Madhya Pradesh
Salvadgi	Bijapur	Karnataka
Sihawal	Sidhi	Madhya Pradesh
Ukri	Singhbhum	Bihar
Vemula	Cuddapah	Andhra Pradesh
Yerraggondapalem	Prakasam	Andhra Pradesh
Mesolithic Sites		
Baghai Khor	Mirzapur	Uttar Pradesh
Baghor-II	Sidhi	Madhya Pradesh
Bagor	Bhilwara	Rajasthan
Banki	Sidhi	Madhya Pradesh
Bhaludungari	Sundergarh	Orissa

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Name of Site	*District*	*State*
Bhangarh	Sundergarh	Orissa
Bhimbetka	Raisen	Madhya Pradesh
Birbhanpur	Burdwan	West Bengal
Bisai	Mayurbhanj	Orissa
Bodra	Mayurbhanj	Orissa
Budha Pushkar	Alwar	Rajasthan
Chopani Mando	Allahabad	Uttar Pradesh
Damdama	Pratapgarh	Uttar Pradesh
Dhaneri	Pali	Rajasthan
Dhanuhi	Rewa	Madhya Pradesh
Didwana	Nagaur	Rajasthan
Ghagheria	Sidhi	Madhya Pradesh
Giddalur	Kurnool	Andhra Pradesh
Hanumanganj	Satna	Madhya Pradesh
Kanawas	Pali	Rajasthan
Khuntagaon	Sundergarh	Orissa
Langhnaj	Mehasana	Gujarat
Lekhahia	Mirzapur	Uttar Pradesh
Mahadaha	Pratapgarh	Uttar Pradesh
Mahadeo Hills	Pachmarhi	Madhya Pradesh
Morhana Pahar	Mirzapur	Uttar Pradesh
Paisra	Monger	Bihar
Patne	Jalgaon	Maharashtra
Rairangpur	Mayurbhanj	Orissa
Renigunta	Chittoor	Andhra Pradesh
Sagoni-I	Satna	Madhya Pradesh
Sagoni-II	Satna	Madhya Pradesh
Saipur-II	Satna	Madhya Pradesh
Sangankallu	Bellari	Karnataka
Sarai Nahar Rai	Pratapgarh	Uttar Pradesh
Sharada Temple-Ia	Satna	Madhya Pradesh
Sihawal	Sidhi	Madhya Pradesh
Singrauli Basin	Mirzapur	Uttar Pradesh
Teri Sites	Tennevelly	Tamil Nadu
Tilwara	Barmer	Rajasthan
Neolithic Sites		
Barudih	Singhbhum	Bihar
Bash	Phek	Nagaland
Brahamgiri	Chitaldurg	Karnataka
Burzahom	Kashmir Valley	Jammu & Kashmir
Chechar Kutubpur	Vaishali	Bihar
Chirand	Saran	Bihar
Daojali Hading	Kachhar	Assam
Dugui	Singhbhum	Bihar
Elchuru	Prakasham	Andhra Pradesh
Golabai Sasan	Puri	Orissa
Gufkral	Pulvama	Jammu & Kashmir
Haimimgai	Mysore	Karnataka
Hallur	Dharwar	Karnataka

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Name of Site	*District*	*State*
Indari	Mirzapur	Uttar Pradesh
Kodekal	Gulbarga	Karnataka
Koldhiwa	Allahabad	Uttar Pradesh
Kuchai	Mayurbhanj	Orissa
Kunjhun	Sidhi	Madhya Pradesh
Kupagal	Bellari	Karnataka
Lalanhiya	Sidhi	Madhya Pradesh
Langhnaj	Mehasana	Gujarat
Mahagara	Allahabad	Uttar Pradesh
Markdola	Kamrup	Assam
Martand	Kashmir Valley	Jammu & Kashmir
Maski	Raichur	Karnataka
Nagarjunakonda	Guntur	Andhra Pradesh
Paiyampalli	North Arcot	Tamil Nadu
Palavoy	Annantapur	Andhra Pradesh
Panchoh	Allahabad	Uttar Pradesh
Peddamudiyam	Cuddapah	Andhra Pradesh
Piklihal	Raichur	Karnataka
Rongigiri	Garo Hills	Meghalaya
Salbalgiri	Garo Hills	Meghalaya
Sangankallu	Bellari	Karnataka
Sarutaru	Kamrup	Assam
Singanpalli	Kurnool	Andhra Pradesh
Sonepur	Gaya	Bihar
T. Narsipur	Bellari	Karnataka
Tekklakota	Bellari	Karnataka
Terdal	Bijapur	Karnataka
Thusekgiri	Garo Hills	Meghalaya
Utnur	Mahaboobnagar	Andhra Pradesh

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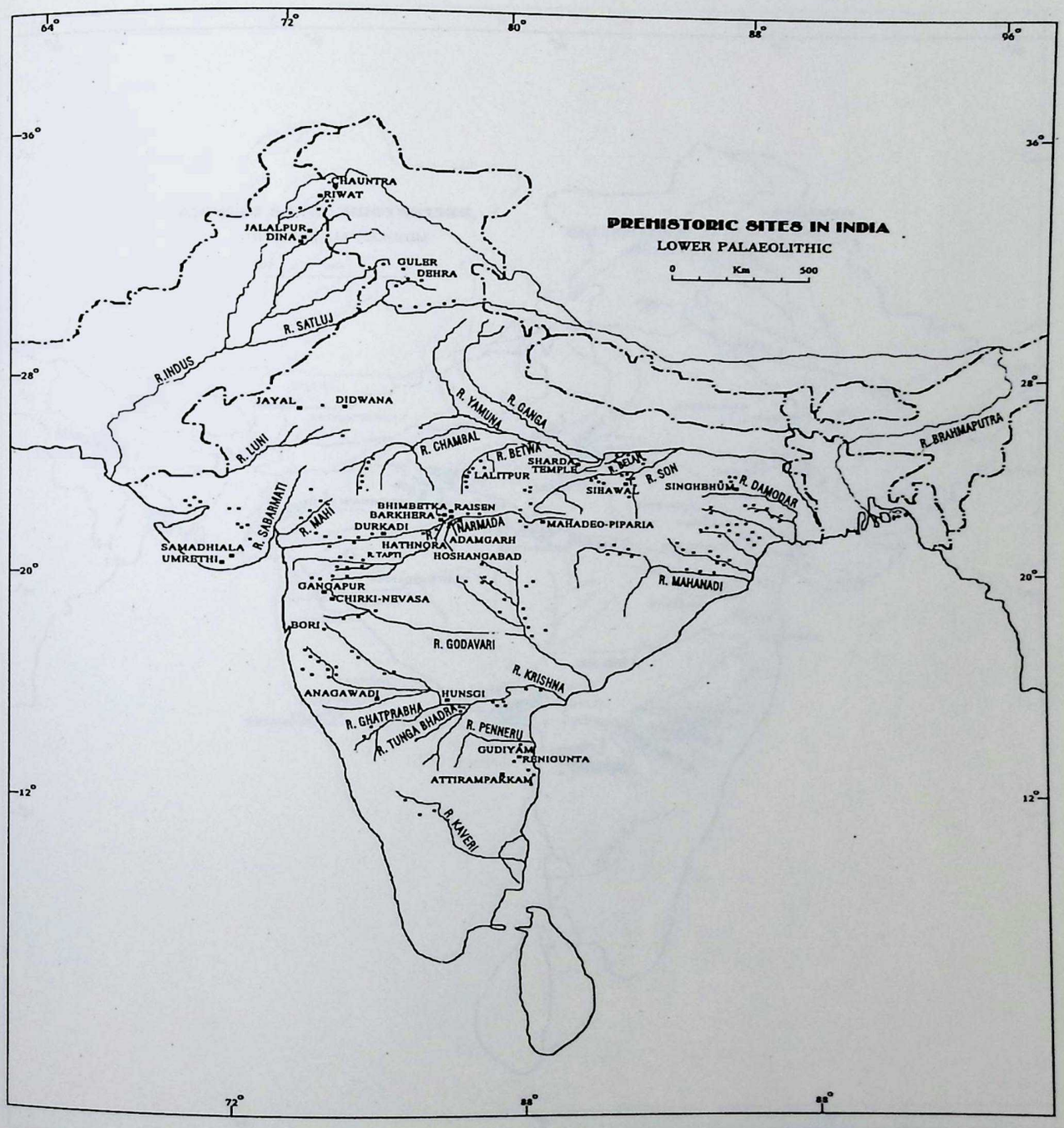

Fig. 1: Principal Lower Palaeolithic Sites in India.

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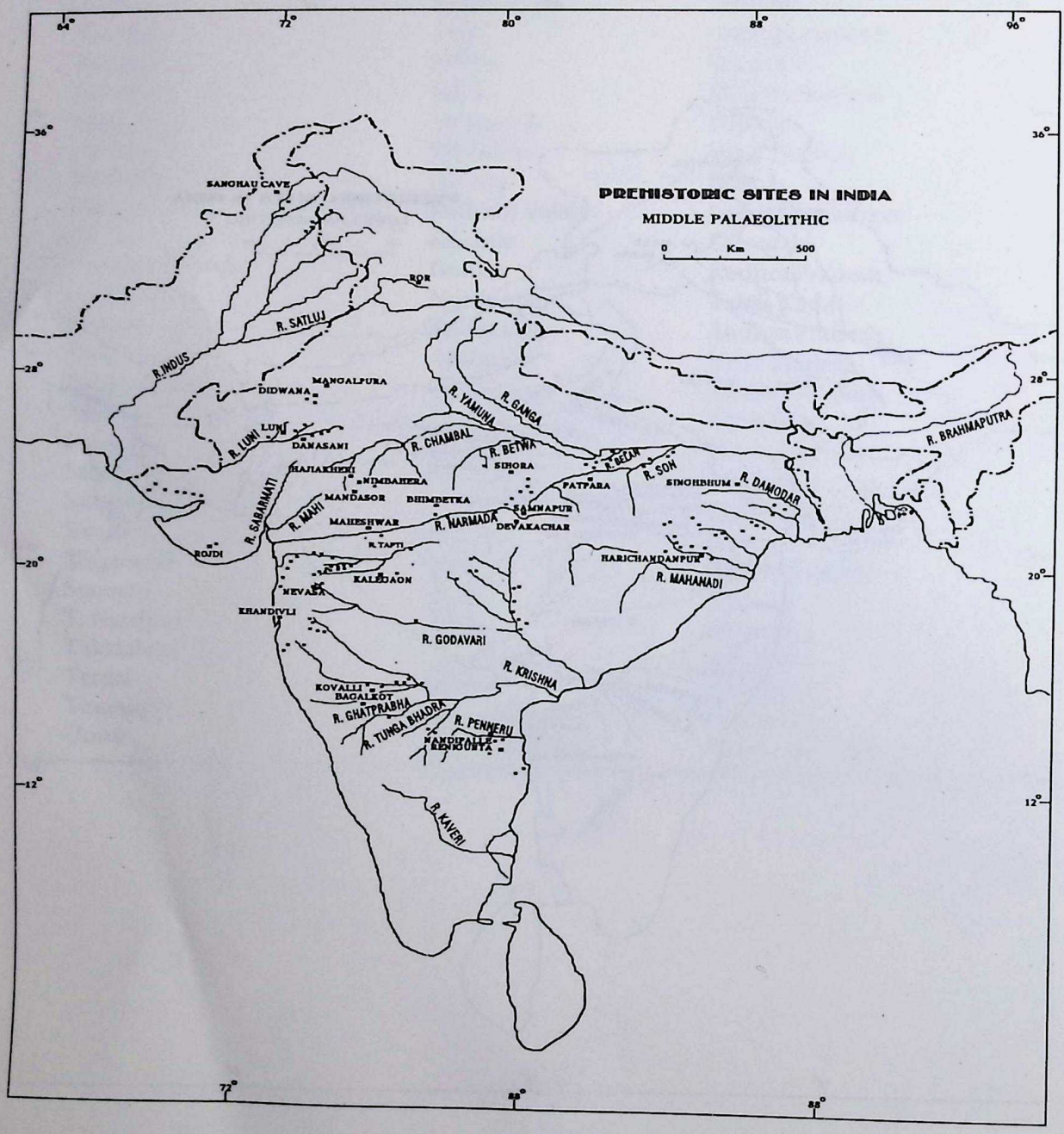

Fig. 2: Principal Middle Palaeolithic Sites in India.

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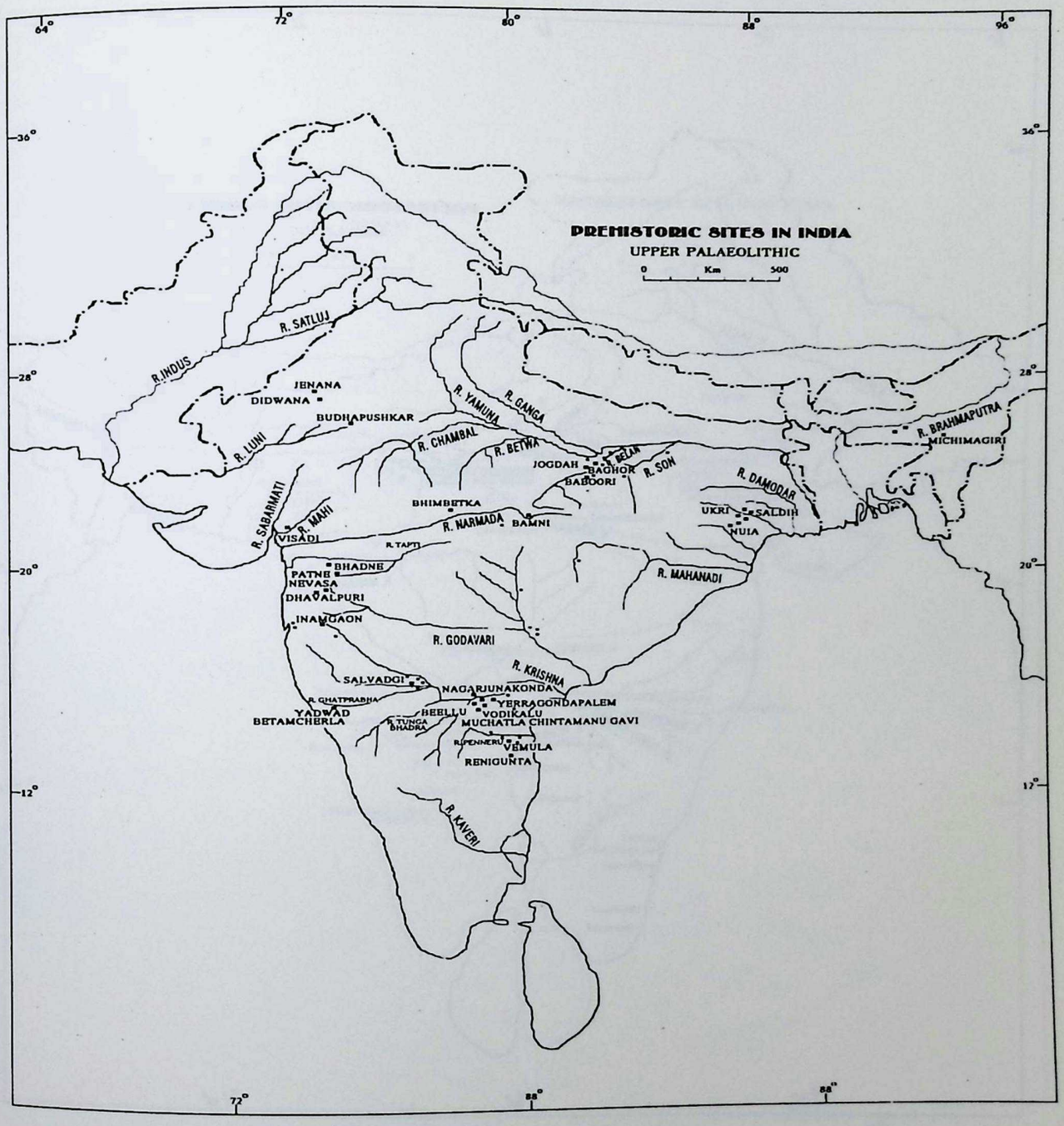

Fig. 3: Principal Upper Palaeolithic Sites in India.

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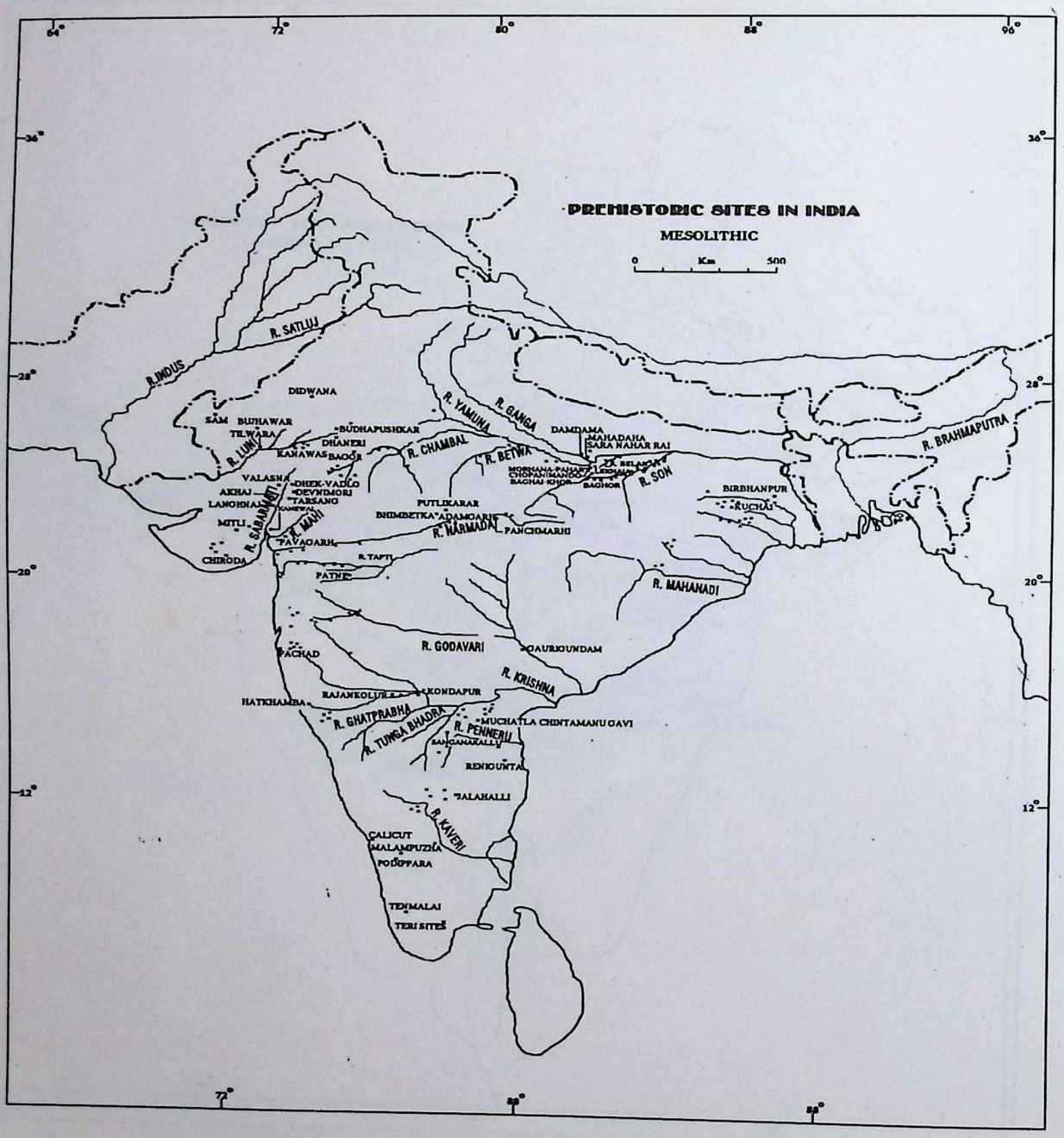

Fig. 4: Principal Mesolithic Sites in India.

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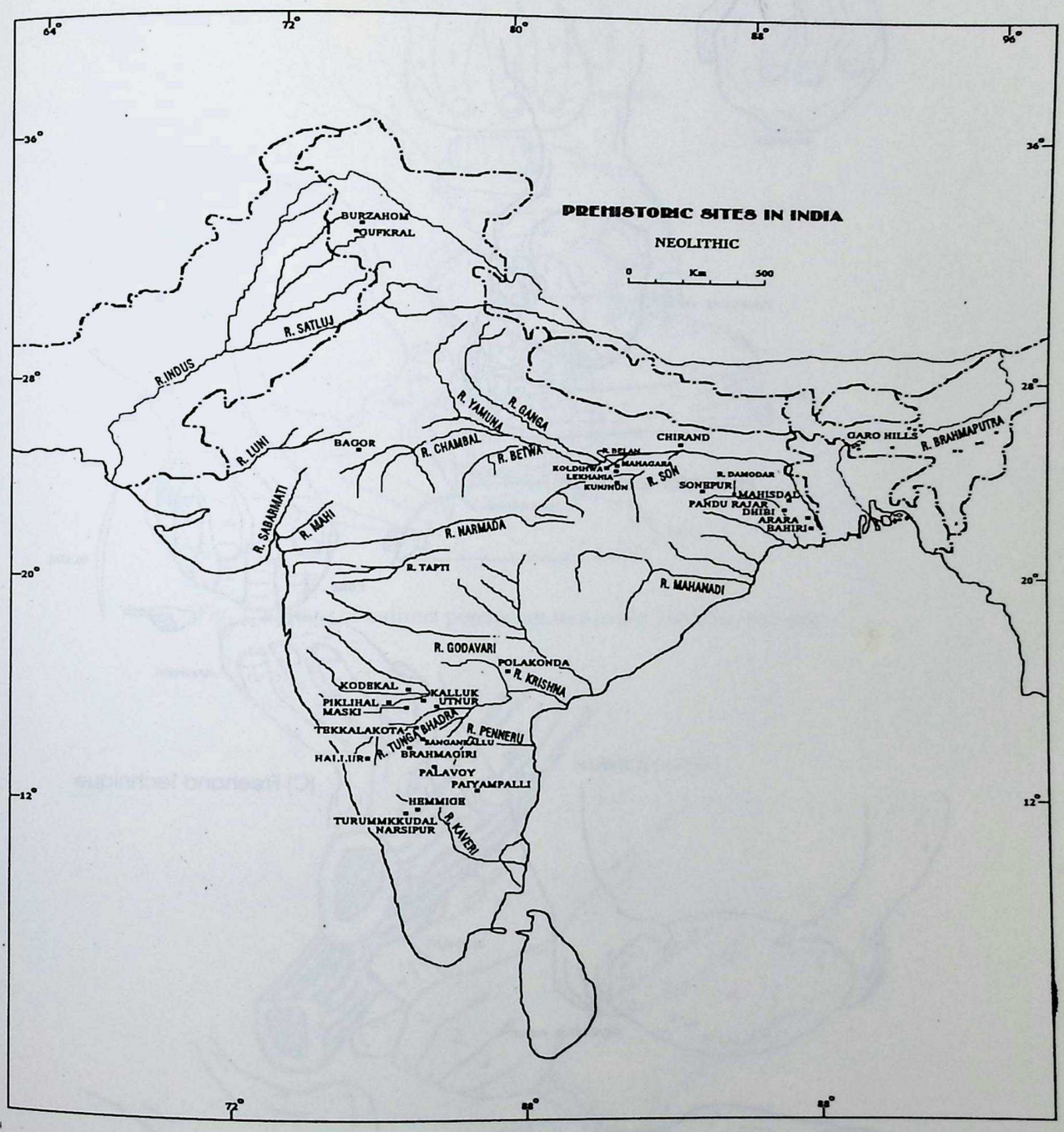

Fig. 5: Principal Neolithic Sites in India.

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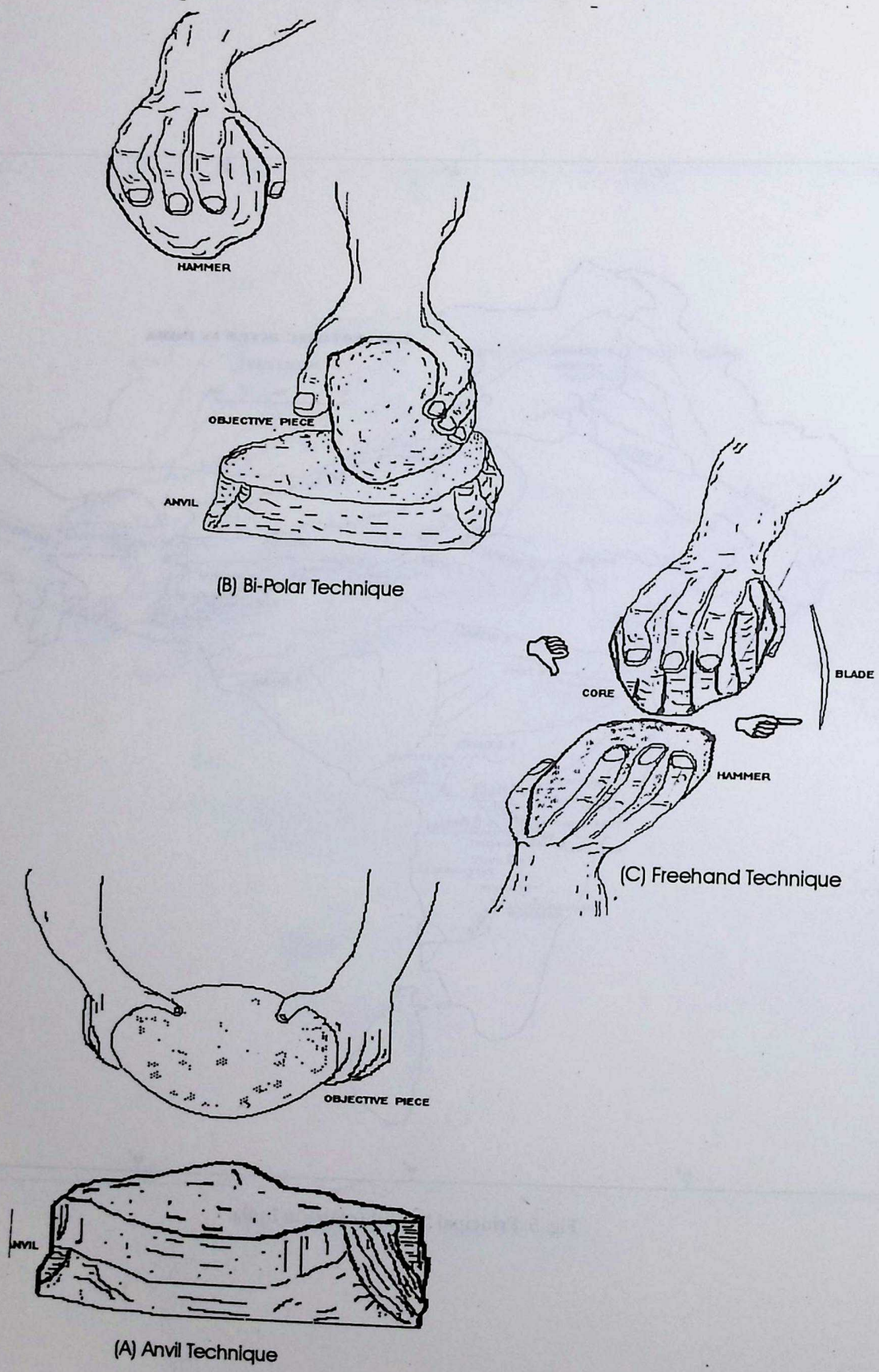

Fig. 6: Variant Forms of Direct Percussion Technique.

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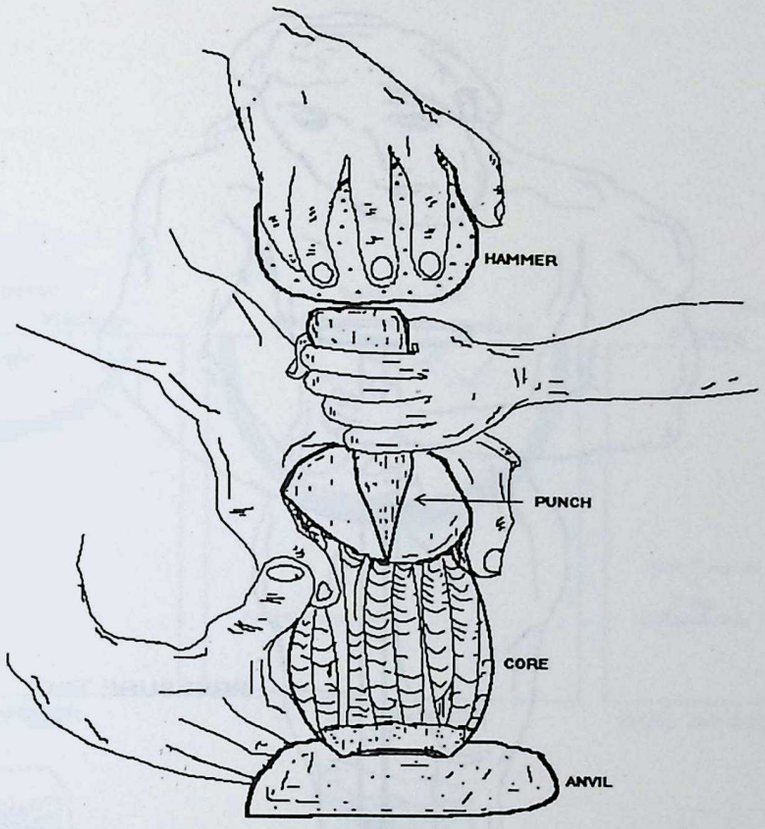

Fig. 7: Variant of indirect percussion technique: involving two men.

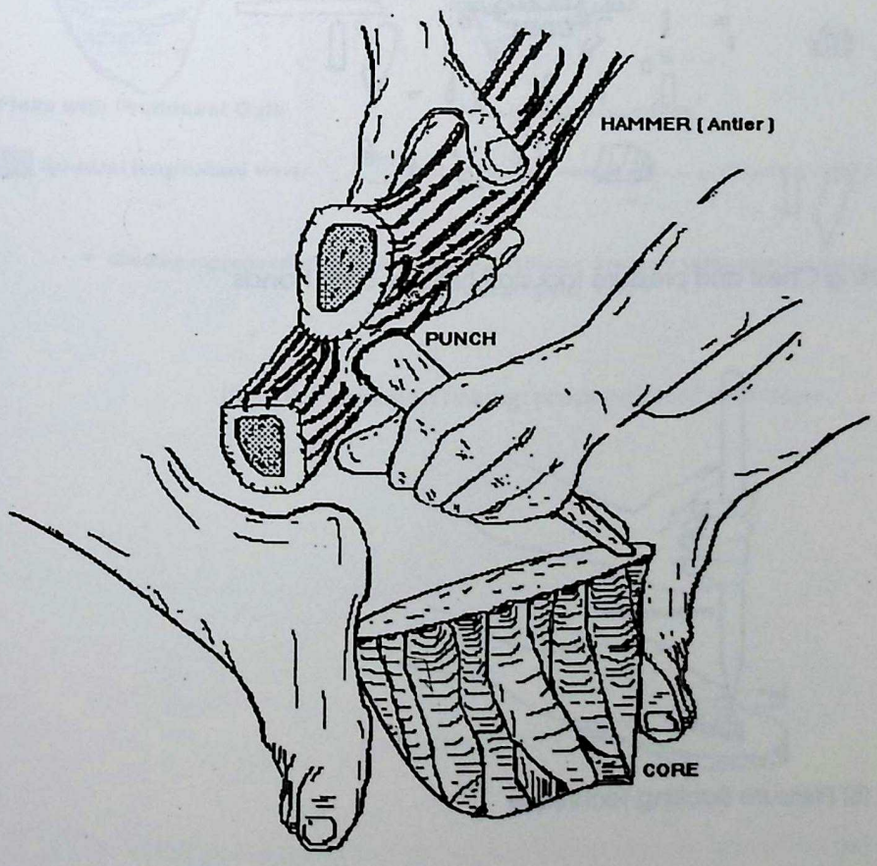

Fig. 8: Variant of indirect percussion technique: involving both hands and legs.

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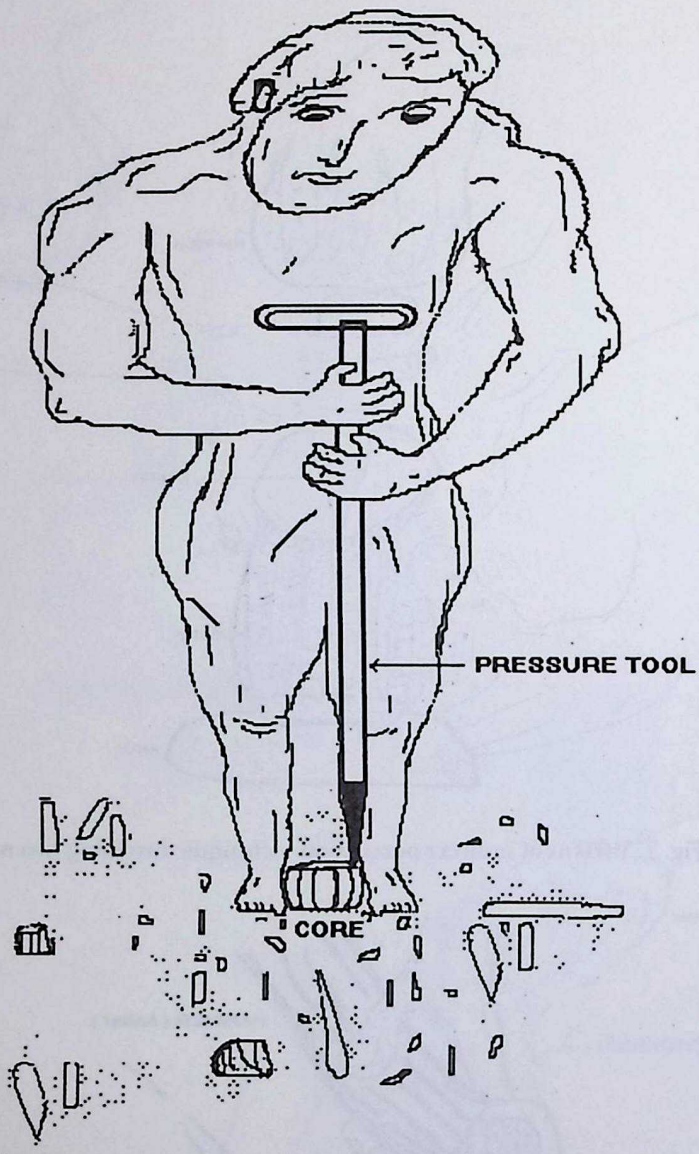
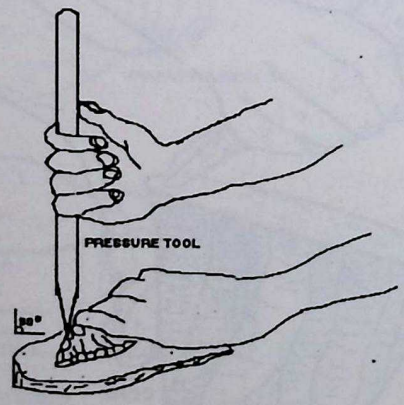


(A) Using Chest and pressure tool staff held by both hands



(B) Pressure Backing Technique

Fig. 9: Variant forms of pressure technique.

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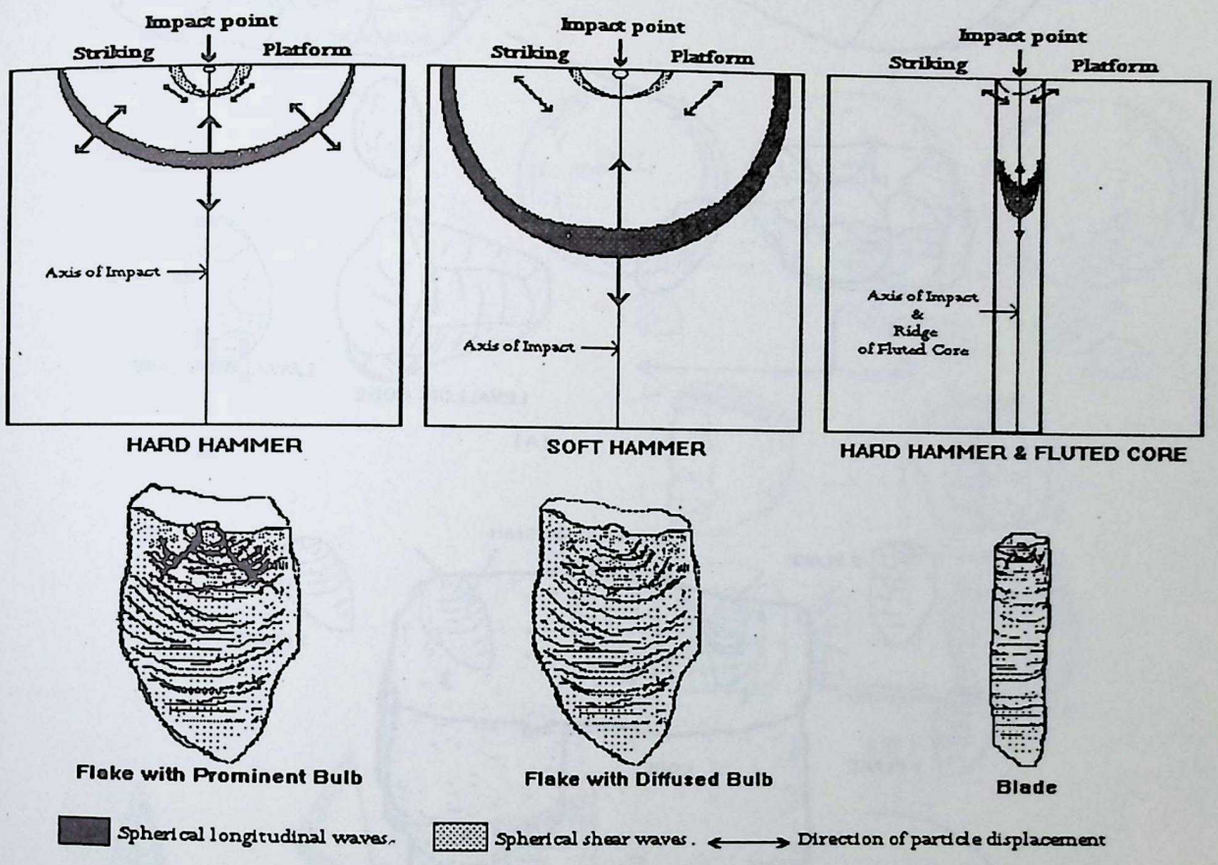

* Shading suggests relative pulse intensity in different directions with respect to axis of impact.
(After John D. Speth, 1972)

Fig. 10: Percussion flaking: propagation of stress wave.

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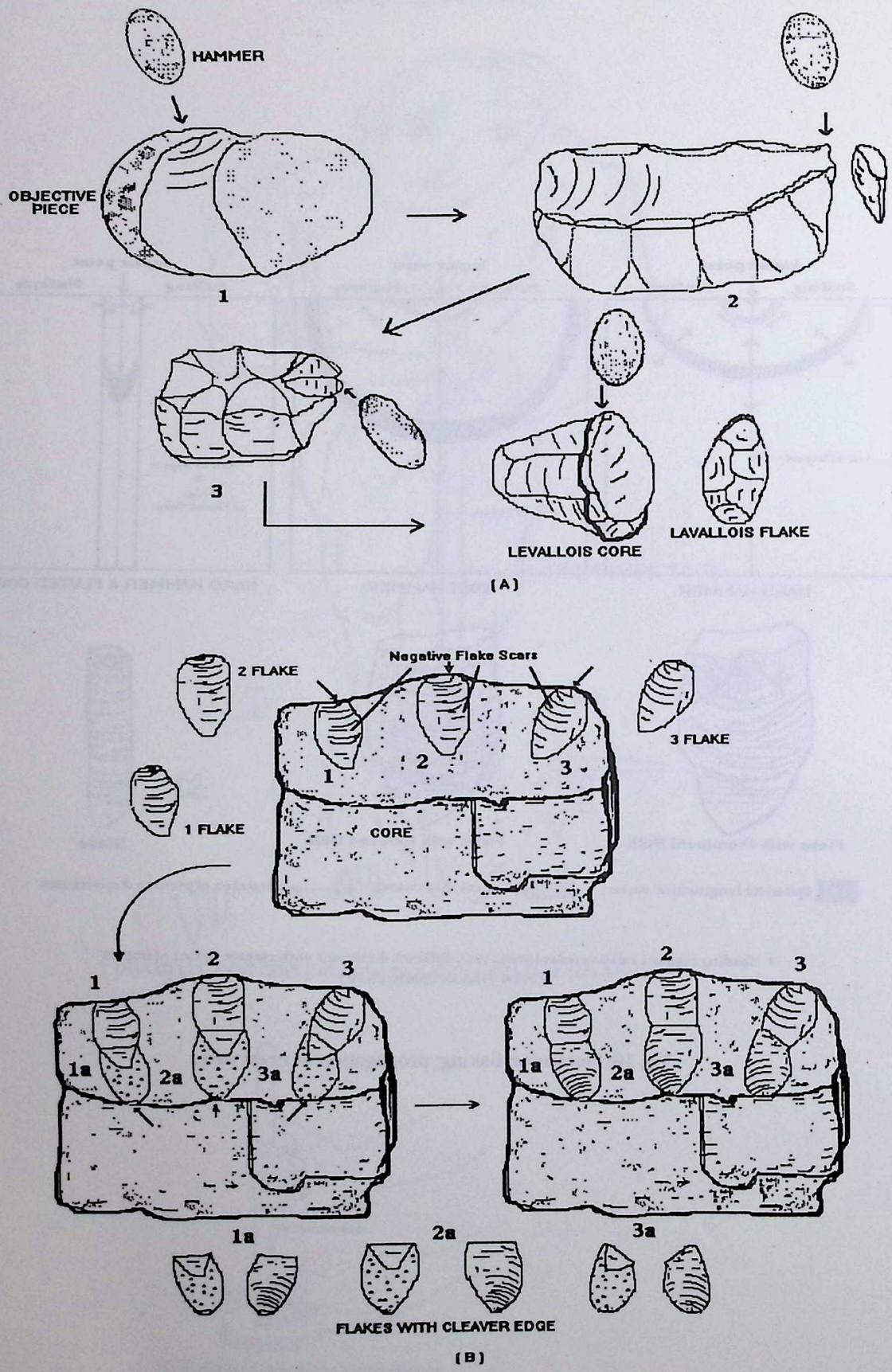

Fig. 11: Specialized flint working techniques: (a) Levalloisian technique, (b) Flake-cleaver technique.

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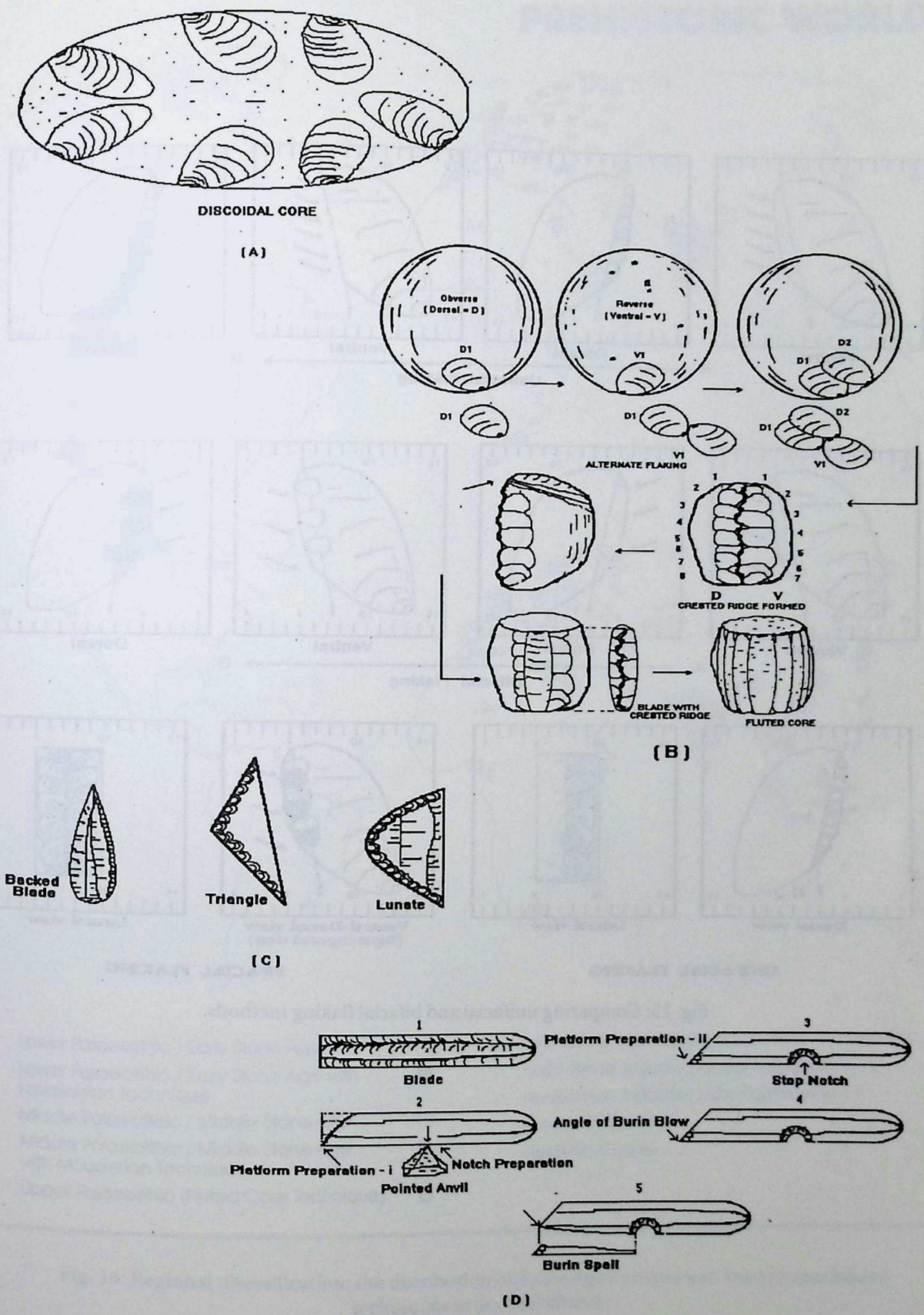

Fig. 12: Specialized flint working techniques: (a) Mousterian technique, (b) Fluted core technique, (c) Backing technique, (d) Micro-burin technique.

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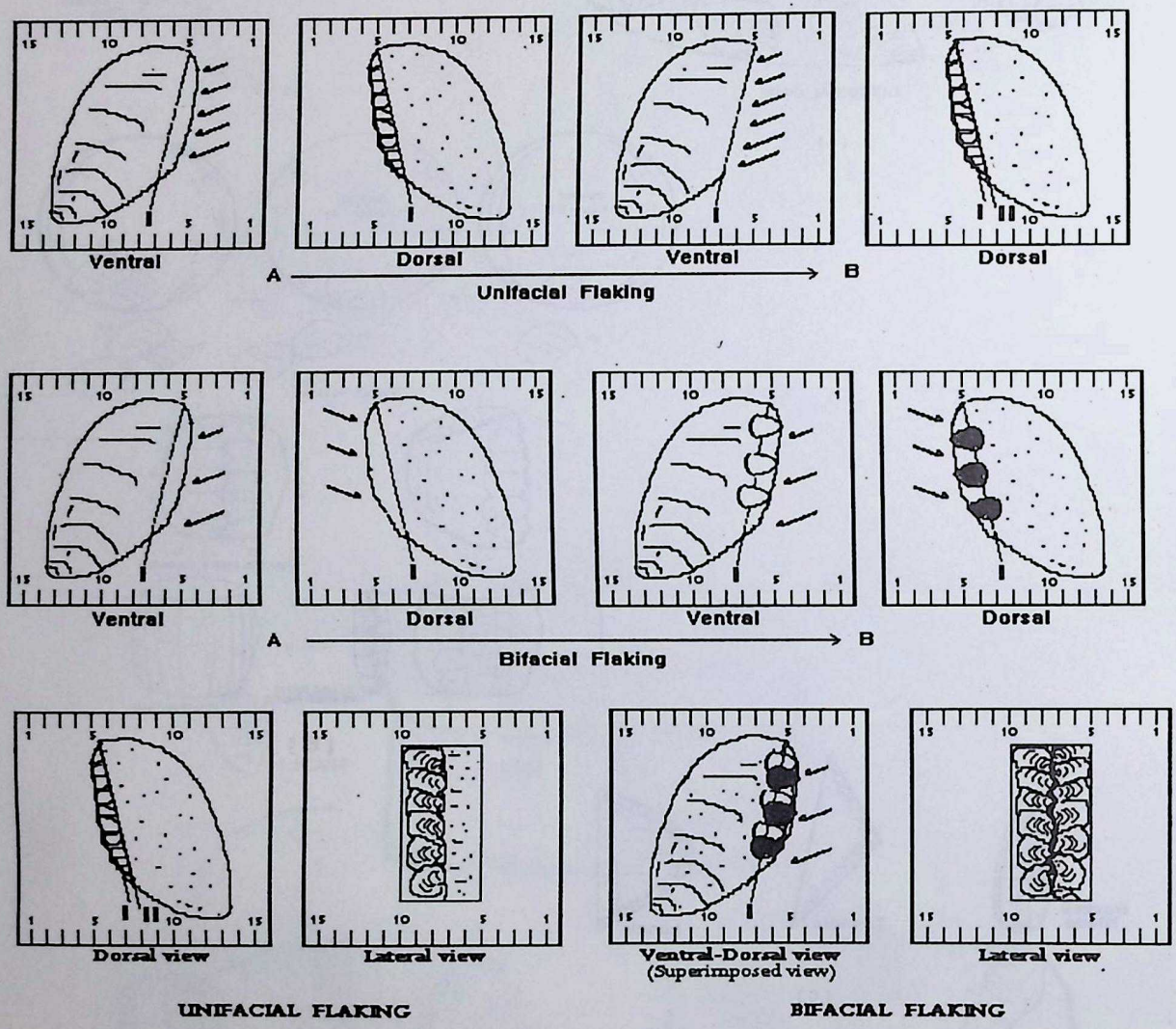

Fig. 13: Comparing unifacial and bifacial flaking methods.

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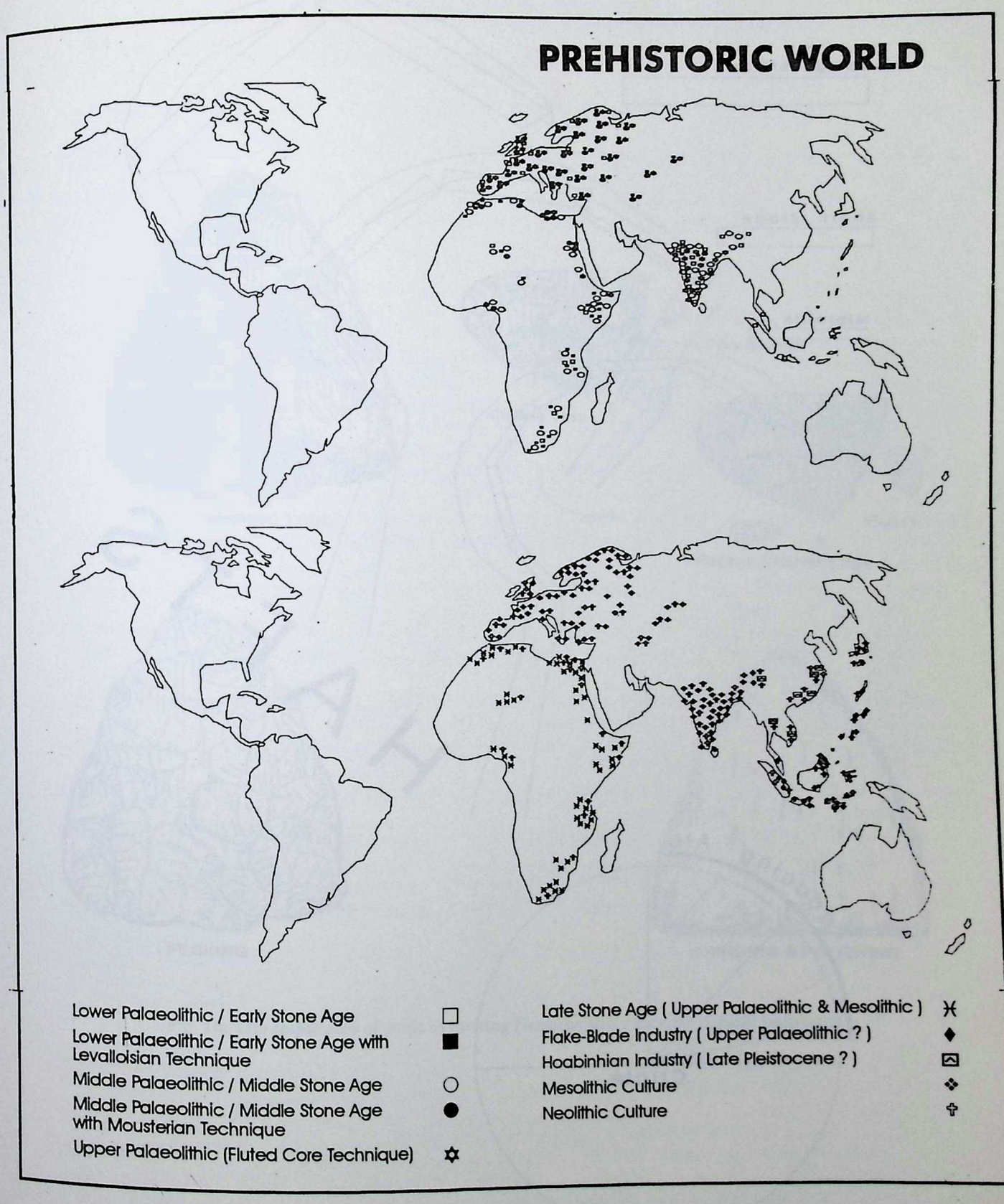

Fig. 14: Regional diversification: the distribution of Stone Age cultures and related specialized techniques in the Old World.

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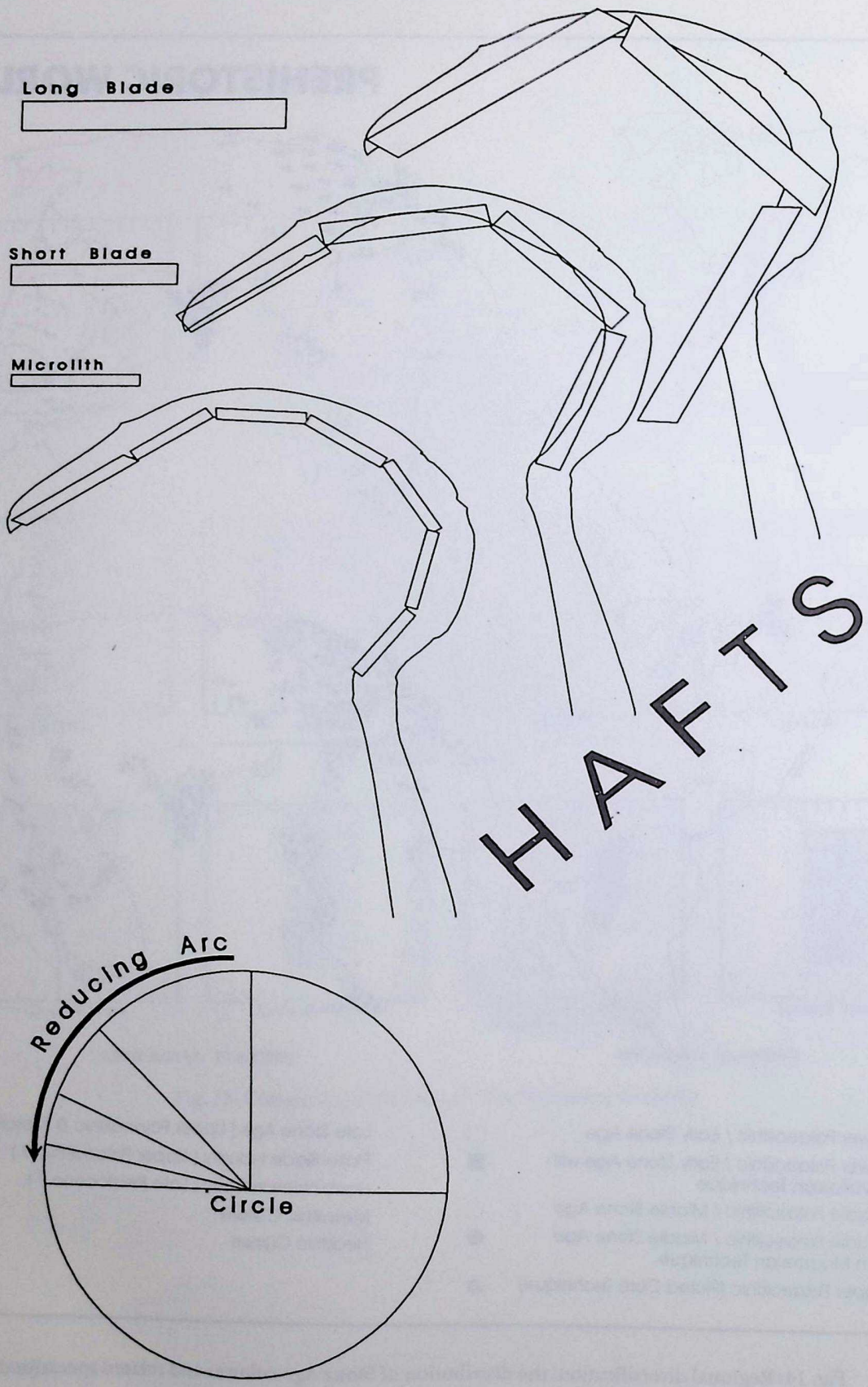

Fig. 15: Rationale behind reducing the length of blades.

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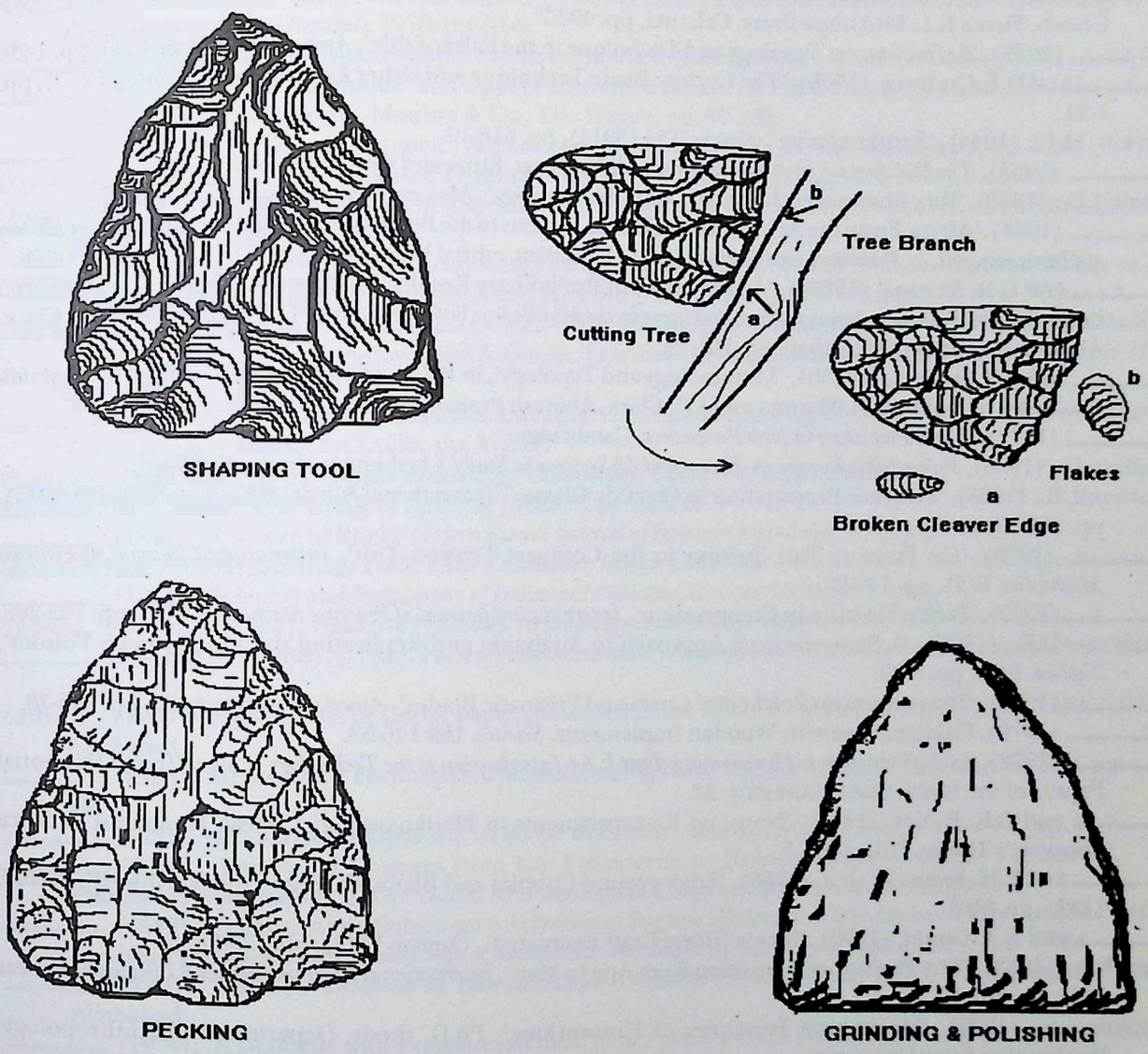

Fig. 16: The sequences of steps in making Neoliths and rationale behind polishing.

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CHAPTER VIII

The Emergence of Culture in the Vindhya-Ganga Region with Special Reference to Old Stone Age

Radha Kant Varma

The Vindhyan region overlooking the Mid-Ganga valley has played a very important role not only in the preservation of the cultural heritage of early man but also in the evolution of his culture. Among the pioneers who brought this region on to the Palaeolithic map of India mention may be made of Cockburn (1888) who located Palaeolithic implement-bearing deposits in the drift gravels of the Singrauli Basin in the then Mirzapur District. It was among the first few stratified sites to have been discovered in India. The Yale-Cambridge Expedition which visited India in 1935 studied archaeological materials and correlated them with geological deposits in the glaciated Zones of north and north-western India on the one hand and the pluvial zones of the Narmada basin in central India and in the peninsular India near Madras respectively, on the other, referred to the strategic position of the region under discussion (De Terra et al., 1939). They visualized this region to be congenial for the evolution of culture, probably on account of it being slightly away from the epicenter of extreme climatic zones. Later, in 1949, the Pan-Indian Prehistoric Exploratory Expedition which visited India under the directorship of F.E. Zeuner chose this region for intensive explorations. V.D. Krishnaswami and Soundara Rajan of the Archaeological Survey of India accompanied Professor Zeuner during explorations in the region. They rediscovered the site earlier reported by Cockburn. Soundara Rajan and Krishnaswami brought out a detailed report on the result of their exploration (K.V. Soundara Rajan and V.D. Krishnaswami, 1951). After this important work no systematic exploration was done in the region for nearly a decade, except for reporting a few stray sites.

In the early sixties the present author undertook systematic explorations of the then district of Mirzapur and the adjoining regions as part of his D.Phil. dissertation programme. As a result, the full potential of the region in understanding the vexing problems of Indian prehistory were revealed (R.K. Varma, 1965). The department of Ancient Indian History, Culture and Archaeology, Allahabad University, took up the Exploration of Stone Age sites in the Vindhyan region in the districts of Banda, Allahabad, Varanasi, besides Mirzapur, in Uttar Pradesh and Rewa and Sidhi in Madhya Pradesh, as a major research project. As a result intensive explorations in the valleys of the river systems flowing in the Vindhyan region, along with the Vindhyan plateau and mountain ranges, were carried out (Indian Archaeology – A Review from 1957-58 onwards). A number of Indian and foreign scholars and agencies also

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participated from time to time in order to understand the geological sequence, specially of the Pleistocene period and their correlation with the archaeological material. Among such teams special mention may be made of the Geological Survey of India, Deccan College Research Institute, Pune, and Professor Clark with his team from California University, USA, and the National University, Australia.

THE VINDHYAN REGION

The Vindhyan region (Fig. 1), as stated above, was and is still being systematically explored for prehistoric settlements and a very large number of sites have been discovered. The river valleys, specially that of the Belan which flows into a trough like formation between the Kaimur and the Central Plateau south of the Ganga, the mid-Son valley south of the Kaimurs between Sihawal and Patpara and the Adwa Valley which flows between the Son and the Kaimur in a narrow valley, were most intensively explored from 1963 onwards. As a result of field studies made in the regions mentioned and elsewhere, a lot of valuable material concerning the emergence and evolution of culture has come to light. But of all the river valleys where studies of prehistoric man have been made, the Belan Valley is the only region where a complete sequence of the development of man is preserved in the stratified Pleistocene deposits. The geomorphology of the Belan Valley is such that actually no shifting of deposits was possible. It is located between the Kaimur ranges of the Vindhyan hills and the Central plateau to the south of the Ganga in a trough-like formation which is 16-24 km wide and nearly 40 km long. The river Belan may be a remnant of an earlier drainage system. The Belan and its tributary, the Seoti, and a large number of *nalas* have laid bare the Pleistocene deposits which contain the history of man's evolution right from the earliest times to the Mesolithic or even up to a later period. Throughout its length and width the sequence of deposits is monotonously the same. Right from Daiya to Deoghat in Koraon Tehsil of Meja sub-division, nearly 18 m high sections repeat the same story. Hence, the Belan section can be taken as the most representative section of the Vindhyan region (Fig. 2, Plate 1). Sankalia refers to it as a 'text-book section' (H.D. Sankalia, 1974).

Stratigraphy

Lower Palaeolithic: The Lower Palaeolithic assemblages in the entire region, wherever they are in stratified deposits in the river valleys, are associated with the First Aggradational Phase of the rivers and are preserved in cemented gravels which are generally compact and hard and consist of large-sized pebbles, rubble and, in some cases, boulders also. Generally, they are at the bottom of the sections overlying the bed-rock. Sometimes they are capped by a sterile silt deposit. In the Belan section, on the bed-rock lies a layer of decomposed rock which has an average thickness of 1.52 m. This deposit is termed as layer (10). Over this lies the First gravel composed of unsorted rubble, pebble, *kankar* and lateritic pallets. This gravel deposit yields lower palaeolithic tools. This in turn is overlain by a thick silt deposit with an average thickness of 3.04 m. It is a sterile layer.

In order to understand the stratification of tool types within the Lower Palaeolithic, if any, levels of the find spots of different types of tools within the section were carefully checked. The study revealed that among the tools recovered from the lowest stratum the pebble tools constituted nearly 10 per cent of the total assemblage. Crude hand axes form nearly 53 per cent and the rest include evolved Acheulian scrappers and cleavers. Cleavers make their appearance fairly late.

Middle Palaeolithic: Stratigraphically, the Lower Palaeolithic in the Vindhyan region was succeeded by the Middle Palaeolithic industries of blade-flake-scraper tradition. The Middle

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Palaeolithic is normally related with the Second Aggradational phase of the rivers and are found in the second gravel which lies over the first silt. It occupies a little higher position in the stratified sections. The first and the second gravel of a river differ considerably in composition. The second gravel is generally devoid of large pebbles, rubble and boulders. It is composed of small gravel pieces and coarse sand. But the thickness of the deposit is greater than that of the first gravel. The stratigraphic position of the Middle Palaeolithic in the Vindhyan region is best reflected in the Belan valley. There Middle Palaeolithic is associated with layers (7) and (6); layer (7) is in fact the second gravel and layer (6) is the overlying reddish silt.

The average thickness of the second gravel is 2.74 m. The gravel is completely devoid of rubble, and is comparatively very small. The percentage of lateritic pallets is so high that the gravel looks reddish. The second gravel is divisible into three distinct sub-divisions based on their composition and contents. At places these are separated by a thin layer of fine sand. For the sake of convenience these sub-divisions have been leveled A, B and C. Their respective features are described below:

A. This is the lowest sub-division. It has yielded tools, largely made of flakes, cleavers and scrapers made on quartzite. Cleavers constitute nearly 10 percent of the findings. In size they are smaller than those of the Lower Palaeolithic. In some tools, evidence of retouching can be seen. The absence of hand-axes, the limited percentage of cleavers, the increase in the flake element, the diminution in the size of tools presage the coming change in the tool tradition. The archaeological material is associated with animal fossils.

B. This layer overlies sub-division A and is completely devoid of Lower Palaeolithic tool assemblages. In this layer, besides quartzite other types of finer varieties of stone tools are also found. Of the tool assemblage, scrapers constitute 73 percent, of which 57 percent are made on quartzite and 43 percent on stones like chert, etc. A very large number of animal fossils are associated with this deposit.

C. This overlies sub-division B. It has yielded tools of blade-flake-scraper tradition in which finer stone material, such as chert, jasper, etc. form nearly 80 percent of the total assemblage.

The overlying reddish silt deposit is composed of calcium carbonate, lateritic pallets and stone chips. The deposit has an average thickness of 1.26 m. It has yielded typical tools of the middle Palaeolithic period in which scrapers form 85 percent and blades 15 percent. The tools are made of chert and similar material.

The stratigraphic evidence, as revealed by the three phases of the second gravel, is extremely important because here we, for the first time, come across evidence of gradual transformation of tools from the Lower Palaeolithic to the Middle Palaeolithic.

Upper Palaeolithic: The Middle Palaeolithic in the Vindhyan region was followed by the Upper Palaeolithic which is represented by the Blade and Burin industry and in stratigraphic sequence it overlies the Middle Palaeolithic and underlies the Mesolithic deposits. In geological context they are placed within the Terminal Pleistocene and Early Holocene. In the Belan section layers (5), (4) and (3) are associated, with the Upper Palaeolithic. Layer (5) is transitional between the Middle and the Upper Palaeolithic and layer (3) between the Upper Palaeolithic and the Mesolithic, layer (4) is truly Upper Palaeolithic.

Layer (5) is composed of yellowish silt and has an average thickness of 1.52 m. Among the tools yielded by this layer, thick, broad and long blades predominate though the typical Middle Palaeolithic tools are also found with the blades. Besides chert, other fine grained material is also used for the manufacture of tools.

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Overlying layer (5) is the third gravel in the Belan valley. Its average thickness is 1.21 m. In the Belan section it is not very well consolidated. At places it is loose and uncemented. The gravel is composed of comparatively finer material. In the Son valley, the Upper Palaeolithic tools have been obtained from the Baghore formation which is made up of two distinct and contrasted fluviatile units: a lower, cross-bedded sandy member and an upper member of horizontal clays and silts. Fresh Upper Palaeolithic artifacts are found within the upper member, and rolled Middle Palaeolithic implements within the lower member. These two members are attributed to the cold, dry Terminal Pleistocene and warm, wet Early Holocene respectively. Layer (3) in the Belan valley represents a period of transition between the Upper Palaeolithic and the Mesolithic.

Mesolithic: The Mesolithic sites are located on top of the section, on different terraces, on the banks of rivers and nalas away from the flood plain. The tools are found where the top soil has eroded or in the gullies made by flowing water. In the Belan section, layer (2), which is 2.43 m thick, is truly Mesolithic.

Location of Factory Sites

Outside the river valleys a very large number of factory sites have been located in the Vindhyan region. There is a very great homogeneity in the selection of sites of different periods.

Lower Palaeolithic: Away from the river section and river-bed, Lower Palaeolithic sites are found on top terraces of the rivers and on hillocks jutting out of the main hills where a finer variety of quartzite is available as rubble or can be quarried from the exposed rock mass. On most of the hillock south of the Belan such as Murli Mahugarh Chandatari, Ramgarh, Belrahi, to name a few, Lower Palaeolithic sites have been located (Fig. 1). A large number of Lower Palaeolithic tools have been collected from such sites.

Middle Palaeolithic: Besides the river valleys, the Middle Palaeolithic sites are located on the slopes of hills and very low hillocks under the shelter of high hills and on the terraces of the rivers. Among the Middle Palaeolithic sites of the Vindhyan region, mention may be made of Bataubir, Khutabir, Marwa, Naunkalan, south of the Belan valley and Patpara in the middle Son valley (Fig. 1).

Among all the sites of the Middle Palaeolithic special mention may be made of Bataubir which is located on a low hillock near the Nadoh Nala towards the south of the Belan river and to the north of the Kaimur hills. A very large number of tools made on fine-grained quartzite have been collected. The tools are mainly scrapers, blades, points and borers. Scrapers of different types outnumber all the other types of tools and, among them, round scrapers are typical of Bataubir industry. These are made by taking out small, shallow flakes with centrally directed strokes. They have been made by controlled flaking techniques. Middle Palaeolithic man had acquired a great deal of skill and efficiency in flaking techniques. The Levalloisian technique had fully developed by now. In order to make the tools more effective they were finely retouched by taking out minute and regular flakes.

It is very interesting to note that we now suddenly start getting a very large number of animal fossils (Plates 2, 3) from the deposits that are associated with the Middle Palaeolithic assemblages. In the Belan valley, a large number of fossils of *Bos gaurus, Bovidae* spp., *Cervidae* sp., sus. *Hippo, Equus* sp. Rhino, Elephas etc. have been collected. All these fossils have also been found in the lower member of the Baghore formation in the Son valley. The relatively drier condition which followed the end of the period in which the first gravel was formed continued till the onset of the Holocene.

Leaf fossils (Plates 4, 5) have recently been found near Patpara from a number of localities in from the Patpara formation (R.K. Varma (ed.), 1994a). The discovery is a unique

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one. Never before have leaf fossils of such recent date been reported from the Vindhyan region.

Upper Palaeolithic: Upper Palaeolithic sites have been located at the foot of the hills, where they meet the low ground, or on top of low outlying hillocks, slightly away from the present river beds. Probably, the overbank flooding forced the Upper Palaeolithic folk to stay beyond the flood plain. Upper Palaeolithic factory sites have also been located on top of the Kaimurs, in the open air, in close proximity of perennial water sources. Sometimes they are located in close proximity to Mesolithic settlements.

The Upper Palaeolithic industries developed from the Middle Palaeolithic of the region, for which there is sufficient stratigraphic and technological evidence. We have already seen that the blade elements appear for the first time in the tool assemblage of the Middle Palaeolithic and take on a distinctive character during the Upper Palaeolithic. The Upper Palaeolithic blade tradition transforms itself into one of microlithic blades during the Mesolithic.

The regional characteristic in the tool assemblage which was becoming conspicuous during the Middle Palaeolithic attains a definite shape in the Upper Palaeolithic of the region.

So far, more than 225 sites of the Upper Palaeolithic have been located in the Vindhyan region, but in cultural context they differ from each other because they represent different stages of development within the Upper Palaeolithic.

At least three developmental stages have been marked within the industry of the region which are represented by their type sites. The First Stage is represented by the Amardan locality which is situated on the northern side of the medial ridge near the confluence of the river Rehi and Son. The types of tools collected at the locality are parallel-sided blades, burins, borers, scrapers, points, knives, denticulates, simple cores, fluted cores and debitage. The large number of blades that have been collected from the site are thickly patinated and retain patches of cortex and the most important point is that, even though they are parallel sided, they have not been removed from fluted cores. The bulb of percussion is well developed and shows a bulbar-scar as well as shatter marks. But some blades do have faceted platforms and diffused bulb of percussion, which is indicative of the use of the indirect percussion technique. Out of 179 cores, only 15 are fluted. The average length, width and thickness of the blades varies from 4 cm to 8 cm, 1.6 to 3.5 and 0.6 to 1.5 cm respectively. The blades generally have a triangular cross-section. The burins are made on flakes.

There are no backed blades or truncated blades. Lunates do not appear. Bold nibbling retouching was done to sharpen the edge. The largest variety is met among the scrapers. They are comprised of end scrapers, notch scrapers, hollow scrapers, nose scraper, etc., points are leaf shaped, thin and have medial ridges.

The Second Stage is represented by the Patwadh site located on the left bank of the Son, near its confluence with its tributary the Ghaggar. In this stage, too, the general nature of the industry remains the same, except for the fact that blades in general become narrower and smaller in comparison to those of Amardan. The spectacular difference is seen in the cross-section of the blades. Though blades with triangular cross-section are still met with, the number of blades with trapezoidal cross-section increase considerably.

Backed and truncated blades make their appearance. The bulb of percussion on the blades of this stage are diffused. The dorsal side of the blades do not show the same irregular pattern of flake scars. Prepared cores were now used to take out blades. Fluted cores become more prolific. The percentage of burins increases. Among the scrapers, the largest group is that of end scrapers which are made on thick blades by regular retouch. They are followed by notch scrapers, nose scrapers, round scrapers and thumb-nail scrapers.

The industries of both the first and second stages are primarily chert-based in both the Belan and the Son valleys.

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The Third Stage of the Upper Palaeolithic is represented by the Marwa site, which is located on the western toe of Chandwa hill on the right bank of river Tundiari in Allahabad District. The tools recovered from the site are similar to those representing the Stages I and II, but their character changes considerably. The length, width and thickness of the largest number of blades varies from 2 to 4 cm, 0.6 to 2 cm and 0.3 to 1 cm respectively. The cross-section is generally trapezoidal and becomes appreciably thin. The frequency of backed blades increase considerably. The retouching becomes regular and fine. The burins become more prolific. The scrapers of this stage are fashioned on thick blades except for round scrapers which are made on roundish flakes. Lunates now appear for the first time. These are different from the Mesolithic ones. These are large and broad. Their width is more than half their length.

The Upper Palaeolithic tool-bearing deposits in the Belan and the Son Valleys have been placed, on the Palaeontological evidence, in the Terminal Pleistocene and the beginning of the Holocene. More valuable data in this connection has come from a number of Carbon-14 dates from gravel III and gravel IV in the Belan Valley. All the dates obtained so far are consistent. The two dates from the IIIrd gravel are 23,840 BC and 17,765 BC. Since the earliest date is not from the lowest horizon, the Upper Palaeolithic in this area possibly had a still greater antiquity. Recently two dates have been obtained. They are from fourth gravel which represents the last stages of the Belan terrace sedimentation and is much younger than the cemented gravel of three. The dates are 12190 ± 410 BC and 9350 ± 130 BC.

These two dates may be taken as the terminal dates of the full-fledged Upper Palaeolithic. Thus we can safely place the Upper Palaeolithic industry of the region in a time bracket of 30,000 BC to 13,000 BC.

HOLOCENE

The end of the Upper Palaeolithic period marks the end of the Pleistocene and heralds the beginning of moderate climatic conditions. It coincides with the world-wide environmental changes which played an important role in the cultural evolution of man everywhere. With the swing towards a milder climate, the face of the earth changed. The ice-sheets melted and the extensive marshy lands started drying up. Such places were replaced by grassy lands, scrub jungles and dense forests in suitable ecological zones. The changes in the flora greatly affected the fauna also. The mammoths gradually vanished and were replaced by smaller game animals such as cattle, deer, goat etc. To cope with the changing environment and ecological pattern, man had to make adjustments through culture change, by modification of his tools, pattern of living and shifting to more amiable ecological zones. North of the Vindhyas, the Ganga valley was fast attaining its present shape and was gradually becoming habitable. The meandering Ganga was building up its channel and the left over meanders took the form of horse-shoe lakes. The fertility of the soil increased, the wild grasses sprouted up and became a source of abundant vegetal food. It was precisely at this time that man – Epi-palaeolithic man, living in the Vindhyan region started his migration to the Ganga Valley and soon parts of the Ganga Valley were occupied by Mesolithic man, who started building up their nucleus camp sites which, in course of time, took the shape of semi-permanent village societies.

MESOLITHIC

The Upper Palaeolithic tool tradition is now finally transformed into the Mesolithic industries of the region. In Belan valley, layers (3) and (2), and in the Son valley, the lower portion of

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the Khetauni formation, as well as in the excavations of Lekhahia and Chopanimando, where Epi-palaeolithic tools have been recovered from the earliest stratum, amply support this conclusion.

Mesolithic sites are found scattered all over the Vindhyan region wherever, away from the flood plain, water and raw material are available. More concentration of tools are found at places with a commanding view, near rock-shelters, etc. Analysis of the tool assemblages indicate that sometimes the assemblage of one site differs from that of others. Tools found at some sites are completely non-geometric, some have geometric tools also, and some are associated with pottery also. These sites represent different stages of development within the Mesolithic. These variations may also be accounted for by the coming into the area of new peoples belonging to different stages of cultural evolution and their mingling with the local people

CULTURAL EVOLUTION
From the Lower Palaeolithic Onwards

In the dawn of his cultural evolution man made his greatest innovation of all times – the use of artifacts as his extra-corporeal equipment to compensate for his bodily deficiencies, as compared with the defensive and offensive equivalent with which his fellow beings were naturally endowed. Tools – stone, bone, wood used as such as artifacts or fashioned by willful modifications – are material manifestations of his mental capabilities. The growing complexity and diversity in tool typology and technology reflects the gradual evolution in his mental capacity.

Lower and Middle Palaeolithic

Cultural evolution during the Lower and Middle Palaeolithic was extremely slow but it did lay the foundations of man's future, more rapid cultural evolution. The pattern of life during the Lower and the Middle Palaeolithic Eras was not very different, but the *technological* evolution from Lower to Middle is, nevertheless, fairly marked.

Like Palaeolithic man elsewhere, man during the Lower and Middle Palaeolithic in the Vindhyan region primarily used hand-axes, cleavers, scrapers and tools made on pebbles (Plate 6a). A study of the tools recovered *in situ* from the sections revealed that pebble tools were the earliest to be used, followed by hand-axes, scrapers and, last, cleavers. Generally, crude and evolved tools are found mixed together at factory sites. Hand-axes of almost all the known types have been found. The largest measures nearly 38.5 cm and smallest 9 cm. The average length is 15 cm. Cleavers and scrapers taken together constitute only 30 percent of the total assemblage. Scrapers are normally made on flakes. The cleavers are also found to be made on flakes. Their length varies from 17.5 to 11.5 cm, the average being 13-14 cm.

Among the tool assemblages of the Vindhyan region, special mention may be made of 'chunk' tools which are made on pieces of flat stone slab by marginal retouching by removing flakes by centrally directed alternate flaking technique. These tools indicate that the man of the Vindhyan region was experimenting with different types of stone material and was also experimenting in the manufacture of multifunctional tools. Some tools as such have typical characteristics of both hand-axe and cleaver or alongwith those of a scraper. Such tools may be called hand-axe-scraper or cleaver-scraper. Of all the tools of the Lower Palaeolithic, the cleaver, which was a later addition, was the most specialized tool type because it could be used in a variety of ways as a Wood cutter's axe, Kudali or Faurah or as a tool working on a cylindrical surface by simply changing the position of the shaft.

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Cleavers with concave working edges can be used only for scraping or peeling objects which are cylindrical in section, such as tree branches or bones of large animals. In such cases shafts are attached at a right angle to the working edge.

Cleavers that have a convex working edge are most suitable for cleaning hides and for leather work. There is hardly a doubt that Palaeolithic man in the Vindhyan region had started hafting his tools. Such hand axes or cleavers as were meant for hafting had a developed tang in place of a butt-end along with shoulder like projections (Plate 6b). Cleavers were hafted in a variety of ways, according to need. A cleaver if hafted parallel to the working edge can be used as a woodcutter's axe (*kulhari*); if it is hafted to the right of the working edge it can be used as a *kudali* or *faurah*. If the cleaver is used as a woodcutter's axe, the proximal edge will show more wear and tear and the working edge will become slightly oblique. In the largest number of cleavers the working edge is usually oblique, which indicates that people must have been using them for cutting trees, etc.

A handle usually multiplies the efficiency of a tool several times. In a striking tool, it increases the force of the blow by increasing the radius of the swing; in a cutting tool, it increases the force applied by bringing into play the more powerful muscles of the hand (S.A. Seminov, *Prehistoric Technology*, 1964, trans. M.W. Thampbar, p. 173). If we can rely on the evidence derived from the working edge of the cleavers, we can categorically say that man was making use of animal hides after cleaning it for purposes of clothing, shelter and water storage. Since hides are perishable we are not likely to retrieve them from any excavated site.

Palaeolithic man had learnt to cut, clean and make tools of timber also. The evidence of hafting in some of the stone tools and the working edge of cleavers supports the idea that man during this period utilized wood also for making his tools more effective.

There is no direct evidence from the Vindhyan region that Palaeolithic man, here, had learnt to use and control fire but there is conclusive evidence from elsewhere (Chou-kou-tien) that Palaeolithic man not only knew fire but made use of it for purposes of roasting, warmth and light. The same, in all probability, may be true for the Vindhyan region as well. By learning the use of fire for cooking, man considerably enlarged the items of his menu which definitely would have contributed to making his life more comfortable. The fire also provided him with warmth and light and a shield against wild animals.

The small innovations which were made during the Lower Palaeolithic period actually laid the foundations of science and technology because all these are based on the experiences and observations of scores of generations of man. The gradual refinement in flaking technique and in the selection of stones for the manufacture of tools indicate how, through trial and error, Palaeolithic man was acquiring knowledge and how the knowledge thus acquired was being passed over to the succeeding generations, which made development in technology possible. The earliest pebble tools – Abevillian and Early Clactonian tools – were made primarily from utilitarian points of view, but gradually aspects other than utilitarian were also taken care of. As a result, finely flaked tools came to be prepared. Tools gradually become smaller, regular in outline, with shallow flake scars. This indicated man's mastery over flaking techniques. In the earliest or Abevillian tools he used a stone hammer and direct percussion technique. As a result, irregular flake scars were formed. But later, step flaking technique was utilized with soft and cylindrical hammers. Indirect percussion techniques also came into vogue. As a result, shallow and regular flake scars were formed which gave the tools a regular outline. The developed Acheulean tools made by Levalloisian technique indicate that the tools were carved out of the core with a preconceived idea. This very fact implies that the faculty of the human mind was constantly growing.

During the Lower Palaeolithic, man subsisted on hunting and gathering. He roamed here and there in small bands and lived in the open like other animals. What distinguished him from other creatures was his capacity to use stone, bone and wood as his extra-corporeal

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equipment. He communicated with his fellow beings and passed on his experience and knowledge to succeeding generations through education. The knowledge pool thus created became the stepping stone for further progress.

The time span of the Lower Palaeolithic was probably the longest among the subdivisions of Stone Age. Culturally, man made much more advancement in this age than one usually credits him with. In a like manner he must have learnt a good deal concerning the laws of nature which are nothing but generalization from scientific data. After all, the first step in a scientific study is observation, on which all empirical knowledge is based. Unfortunately, the advancements made by Palaeolithic man cannot be tabulated on a graph on account of lack of stratigraphic evidence. Moreover, no primary habitation site of the Lower Palaeolithic period in the Vindhyan region has so far been excavated. Hence, we are not in a position to say anything regarding the pattern of their life.

Climatically and otherwise the Vindhyan region, on account of its proximity to the epicentre of extreme climatic zones, was more conducive for the development of culture than peninsular India or the Himalayan foothills. Moreover, all the conditions essential for the growth and development of culture were available in plenty in the region. Chronologically the Lower Palaeolithic industries of the region may be placed within the Middle Pleistocene period as elsewhere in India

Middle Palaeolithic

Technologically speaking, there is a marked difference between the tool typology of the Lower and Middle Palaeolithic. On the basis of the evidence of the Belan valley, we can safely say that the change was a gradual process. Now the tools are based on flakes and small scrapers, points, blades, etc. comprise the main tool types (Plate 7).

We have already noticed a change in the selection of factory sites. Changes in tool typology and selection of sites may indicate changes in environment and ecological pattern.

So far no skeletal remains of Lower or Middle Palaeolithic man has been recovered, nor has any grave site been excavated. Hence, we are not in a position to shed any light on the human life pattern of the period. We can, however, consider possibilities on the basis of analogy with developments elsewhere.

We know that Neanderthal man had evolved during the Middle Palaeolithic a cranial capacity which was very near to that of *Homo sapiens sapiens.* The Neanderthal man's tool typology also indicates the growing complexity of his mind. The general use of advanced Levalloisian technique precludes a capacity for conceptual thinking. Evidence of abstract thought is indicative of speech and the use of symbols. It cannot be said with certainty that the use of the bow and arrow had started, but it seems almost certain that delicate triangular points must have been used as javelin tips and things like that.

Upper Palaeolithic

As in the case of the Lower and Middle Palaeolithic periods, no skeletal remains of Upper Palaeolithic man of the Vindhyan region has been found. However, on the basis of evidence from elsewhere, we know that *Homo sapiens-sapiens,* modern man, emerged with the dawn of the Upper Palaeolithic and with this increases the pace of cultural evolution. We have indirect evidence of *Homo sapiens sapien's* presence in the Belan valley. We have already seen that there was a gradual evolution in tool typology. The tools are now based completely on blades and a number of new types of tools emerge such as burins, awls, various types of scrapers, points, lunates, etc. (Plates 6a, 6b). This does indicate the emergence of a new type of society. The effective use of bows and arrows must have started from this time. Based on the principle of the concentration of energy, it was a weapon of great usefulness. The use of bows and arrows

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increased the wounding range many times over that of all the hitherto known weapons and increased the speed of attack many times.

ARTISTIC ACTIVITY

The most important innovation of the Palaeolithic man of the Vindhyan region is his artistic activity. Unfortunately, no painted rock-shelter in the region has yet been identified which could be placed within the Upper Palaeolithic period, but the discovery of a figurine of a Mother Goddess made on bone (Plate 9) is sufficient to prove that Vindhyan man indulged in artistic activity and produced mobiliary art objects as did Upper Palaeolithic centres else where. The figurine comes from the eroded gravel III in Lohanda Nala, a tributary of river Belan.

The importance of the artistic remains can in no way be over-emphasized as these provide us with many insights into Upper Palaeolithic life. The discovery of the Mother Goddess figurine and the identification of a place of worship during the excavation at the Baghore site (Plate 10) in Sidhi District, Madhya Pradesh are of immense importance because they provide us with the earliest evidence of a belief in the supernatural by Upper Palaeolithic man in the Vindhyan region in particular and India in general. It does indicate the development of ritual and ceremonies. It reveals the growth of human consciousness and man's effort to understand life beyond the visual world. It not only reveals the gulf developing between man and the rest of the animal world but also gives him a separate identity amongst other living beings. The process of humanization of man gathers momentum from now onwards.

Mesolithic

The pace of cultural evolution during the Mesolithic was very fast as compared to that in the Palaeolithic period which was of much longer duration. We have already seen that, with the end of the Pleistocene period and the onset of the Holocene, the ecological pattern had changed completely. The climatic changes brought about changes in the floral and faunal pattern which in turn influenced man to change, modify and evolve new types of artifacts (Plates 11 and 12) which were compatible with the changed circumstances.

The end of the extreme climatic conditions culminated in the removal of the barriers of snow and inaccessible water-bound regions which had formed due to prolonged glacial and pluvial conditions. This facilitated man's movements, resulting in a mixing of populations. There was a lot of such activity during this period. Now, suddenly, the number of sites multiply many times. Remote or inaccessible areas, where no traces of settlements of the earlier periods are found, were colonized during this period.

The increase in the number of the Mesolithic sites are indicative of the fact that there was a spurt in the population. This could have been due to a number of factors such as large-scale migration and intermingling of people, the moderate climate, easy availability of food due to the development of a more efficient hunting kit and trapping techniques. The commingling with new peoples must have given Vindhyan man a freshness in outlook which is the hallmark of all progress.

During this period the most important event was the opening up and the colonization of the Ganga Valley (Fig. 3) The pace of cultural evolution in the Ganga valley was much faster than it had been in the Vindhyan region.

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THE PATTERN OF LIFE IN THE VINDHYAN REGION

Subsistence Economy

The subsistence economy of Mesolithic man in the Vindhyan region was based mainly on hunting. Gathering played only a secondary role. He used bows and arrows for hunting. The most sought after animals in order of preference seem to have been deer, rhinoceros and boar. Small barking bears, twelve horned stags and spotted deer have been painted again and again on the walls of caves and have been portrayed in hunting scenes also. Laying traps for killing and catching animals was also practised. A number of trap scenes can be recognized in the rock-paintings.

The people of this period supplemented their menu with seasonal fruits, nuts and berries. All these were found in plenty. They must have been making use of some tubers also, just as the present-day tribal people of the region do.

Wild grains and seeds of wild grasses do not seem to have formed part of their subsistence economy because querns and mullers are either absent in the Mesolithic assemblage of the region or are extremely rare.

No hearth has been located through exploration or excavation at any of the sites but the people knew how to use and control fire. A close examination of the tools indicate that some of them were removed from cores which had been made after roasting the raw material in fire. Stone boulders were roasted to obtain conchoidal fracture.

Since hunting was vital for their existence, Vindhyan people moved from place to place in search of food and were not bound to any place. They lived in small bands in rock shelters or in the open.

The artistic impulse which was finding expression in the production of mobiliary art objects, during the Upper Palaeolithic had its flowering in the painting activity during the Mesolithic.

Rock Paintings

A very large number of painted rock-shelters (Plate 13, 14) belonging to the Mesolithic have been located in the Vindhyan region. The rock-shelters are natural and have been made by water action. They vary in shape and size. Paintings have been executed on walls and ceilings. The same surfaces have been used by generations of artists. The paintings, therefore, are generally found superimposed on each other. The subjects, generally, revolves round animals which have been painted again and again in different attitudes. Figures of men have also been portrayed as hunters or dancers. The colours are based on various shades of ochre, and manganese such as red, brown, purple, etc.

The painted shelters are usually located at the most picturesque and sometimes difficult to reach places.

A study in the super impositions reveals that there was a cyclic evolution in the technique of painting, viz., from naturalistic, to stylistic, to symbolic and back to naturalistic.

Socio-Ritual Activity

The excavations in the Baghaikhor and Lekhahia rock-shelters, near the village Bhainsore in district Mirzapur, on the Great Deccan Road revealed that the Vindhyan people buried their dead inside the rock-shelters. The burial (Plate 15) in the Baghaikhor rock-shelter was well preserved and indicated that the burial was meticulously made. The dead were buried in an extended position, lying east-west or west-east. The burials indicate that the people had developed socio-ritual traditions.

The large-scale painting activity also confirms this conclusion. They had probably developed some sort of magico-religious beliefs also which were finding expression in the large-scale painting activity.

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THE PATTERN OF LIFE IN THE GANGA VALLEY

The pattern of life during the Mesolithic developed in an entirely different way in the Ganga valley. The change in ecology not only brought about changes in tool technology but also in the subsistence pattern. We know that microlithic tools are the hallmark of Mesolithic tool technology, but no lithic raw material was available in the Ganga Valley. Hence, alternative strategies were developed to cope with the problem. Two effective ways were devised. Firstly, utmost economy was practiced by reducing the length, width and thickness of the microliths. Residual cores are almost absent. By adopting this method they could draw out larger numbers of microlithic flakes/blades from a single core.

Secondly, bone tool technology was developed as an alternative to lithic tools (Plate 16). A study of the tools recovered from the different layers indicate that the percentage of bone tools in relation to lithic tools increases as we proceed from lower levels to upper levels. It is interesting to note that bone tools are almost absent on the Vindhyan sites.

Besides the hunting-tool kit, vegetal food processing implements such as querns and mullers were developed (Plate 17). Such stone implements outnumber all other types of tools, which indicate that these played a more important role in their subsistence economy.

We have already noticed that the people in the Vindhyan region heavily depended on hunting for subsistence, and gathering played a secondary role. But, in the Ganga Valley, it was just the opposite. People depended more on gathering; and hunting was secondary. This is attested to by the fact that we get large numbers of stone implements such as querns and mullers which are used only for processing vegetal food. The number of such implements gradually increases, whereas the number of hunting implements decreases.

Incipient Village Society

The sites of Damdama, Mahadaha and Sarai Nahar Rai present a picture of an incipient village in which the people lived in small units in huts with separate hearths. Osteological study of the skeletal remains indicates that men, women and children lived together. Skeletons of old persons (more than 40 years of age) and children (about 6 years of age) and adults (between 20 to 30 years of age) have been found. Skeletons of persons more than 40 years of age indicate that the life expectancy on these sites was higher than that on other Mesolithic settlements. Kennedy (1984) who has made a preliminary study of some of the skeletons of Sarai Nahar Rai and Mahadaha is of the opinion that, 'The population had large and robust skulls and they were relatively tall with the stature of males at Sarai Nahar Rai being approximately 173.93 cm to 192.08 cm' (Also Kennedy, 1986). Kennedy feels that 'their large body size and distinctive cranial features reflect a regional adaptation leading to large body size' (1984). It was a significant departure from the life style of the Vindhyan region.

Hutments

The flat Ganga plain did not provide man with natural shelters, hence they made small huts supported on bamboo or *ballies*. At the site of Chopanimando, in the Belan Valley, house plans of 20 circular or oval huts have been recognized in phases III, IIB and IIA (G.R. Sharma, et al., 1980, p. 32). At the site of Sarai Nahar Rai and Damdama too, post holes and at Damdama rammed floors (Plate 18) have been recognized, which indicate that Mesolithic man had started making hutments for purposes of living.

Hearths

The people controlled fire and roasted meat in circular or oval pit hearths. Small hearths have been recognized in the excavations at the sites of Chopanimando, Sarai Nahar Rai, Mahadaha and Damdama (Plate 19). A community hearth was also located at Sarai Nahar Rai.

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Family Unit

As a corollary to the dependence on vegetal food, storage of surplus, etc., was the formation of smaller units within a larger group. It is a well known fact that hunting is a social event but the same may not be true for gathering and processing of vegetal food. Community processing of vegetal food is not an easily feasible proposition. Hence, smaller family units consisting of man, woman and children were formed. The location of small huts, hearths and couple burials further proves this. Couple burials (Plate 20) are a special feature of burial practices on the Ganga Valley sites in which male and female have been buried together in a set pattern. This indicates some sort of male-female relationship. It is interesting to note that in each case the man was first placed in the grave and the female followed. In each case, either the female has been placed to the left of the male or above the male in two tier. The set pattern in which these burials have been made indicate that it had become a common practice.

Population

It is difficult to form an accurate idea of the population during different prehistoric phases because of the limited nature and extent of excavations. However, we can get a rough idea of population size from the last phase, because it was exposed in a larger area. Variables used to estimate population are number of querns and mullers. In traditional rural India, a family unit normally has one set of grinding stones and if we use this model for the prehistoric period we can extrapolate a population estimate. During the last phase of Mahadaha, 191 and at Damdama 110 querns were recovered. If we assume a minimum of four to five persons per unit the population at Mahadaha would work out to between 700 to 1000 and at Damdama from 550 to 650. Considering the size of the habitation site this does not seem to be a wild guess. Moreover, this population would not have been a static one because a good number must be out on hunting or gathering trips within the catchment area.

Socio-Ritual Activity

In conjunction with their subsistence strategies these people had developed important socio-ritual traditions.

Burial Activity: A large number of burials have been located on the Ganga valley sites and a fairly good number of them have been excavated at the sites of Sarai Nahar Rai, Mahadaha and Damdama. They indicate that they all have been prepared in a set pattern. The meticulous way in which the graves have been prepared and the way the skeletons lie represents the performance of a ritual at a group level. The graves are usually oblong and shallow. The width was increased in case the grave was meant to receive more than one body. The excavations of burials at Damdama (Varma, et al., 1985b) suggest that some sort of fire ritual was performed in the grave itself just before burying the dead. Generally, the bodies were placed west-east, with the head towards the west. But some graves with east-west orientation have also been found. There is one exception in which a couple has been buried north-south and south-north orientation (Plate 21).

The bodies have generally been buried in extended position on their back. In one case, a body has been placed in a supine position. There is one exception however, in which the burial has been made in flexed position with the femur, tibia and fibula bent and placed upward. It is oriented east-west. This was a general practice in Langhanaj, Gujarat. Since people stick to their traditions in last rites, etc., it is just possible that the variation in burial tradition might indicate a mingling in of new people. Burial goods in the form of microliths, bones, fresh water molluscs and antler ornaments (sometimes) not only confirms that the people had developed elaborate ritual practices but also that they believed in life beyond death.

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The orientation of the burials either east-west or west-east is also not without significance. The orientation must have been guided by the warmth and life giving qualities of the sun. Slight differences, of degrees in the orientations which is found in the burials might have been due to the position of the sun during different periods of the year. It may not be unreasonable to trace the beginnings of sun worship to the Mesolithic.

Aesthetic Sense

The aesthetic sense of the Mesolithic people of the Ganga Valley found its expression in fashioning objects of personal adornment. Ear-rings and necklaces have been recovered from three graves at Mahadaha (Sharma, et al., 1980, pp. 108-9). Two male individuals (Skl. 5 and 7) were buried adorned with necklaces made from rings sliced from antlers (Plate 22).

Ornaments are used not only for personal adornment, they are also indicative of status in a society. It is just possible that the people who were found buried wearing ornaments held special positions in their social order. Thus, we may conclude that some sort of leadership principle had evolved.

How these Mesolithic settlements met their end cannot be said at present. We do not find any evidence that these people took to cultivation. Undue growth of population might have been one of the reasons for the desertion of the Ganga Valley lake settlements. The growth might have resulted in depletion of resources which necessitated shifting to a more favourable location.

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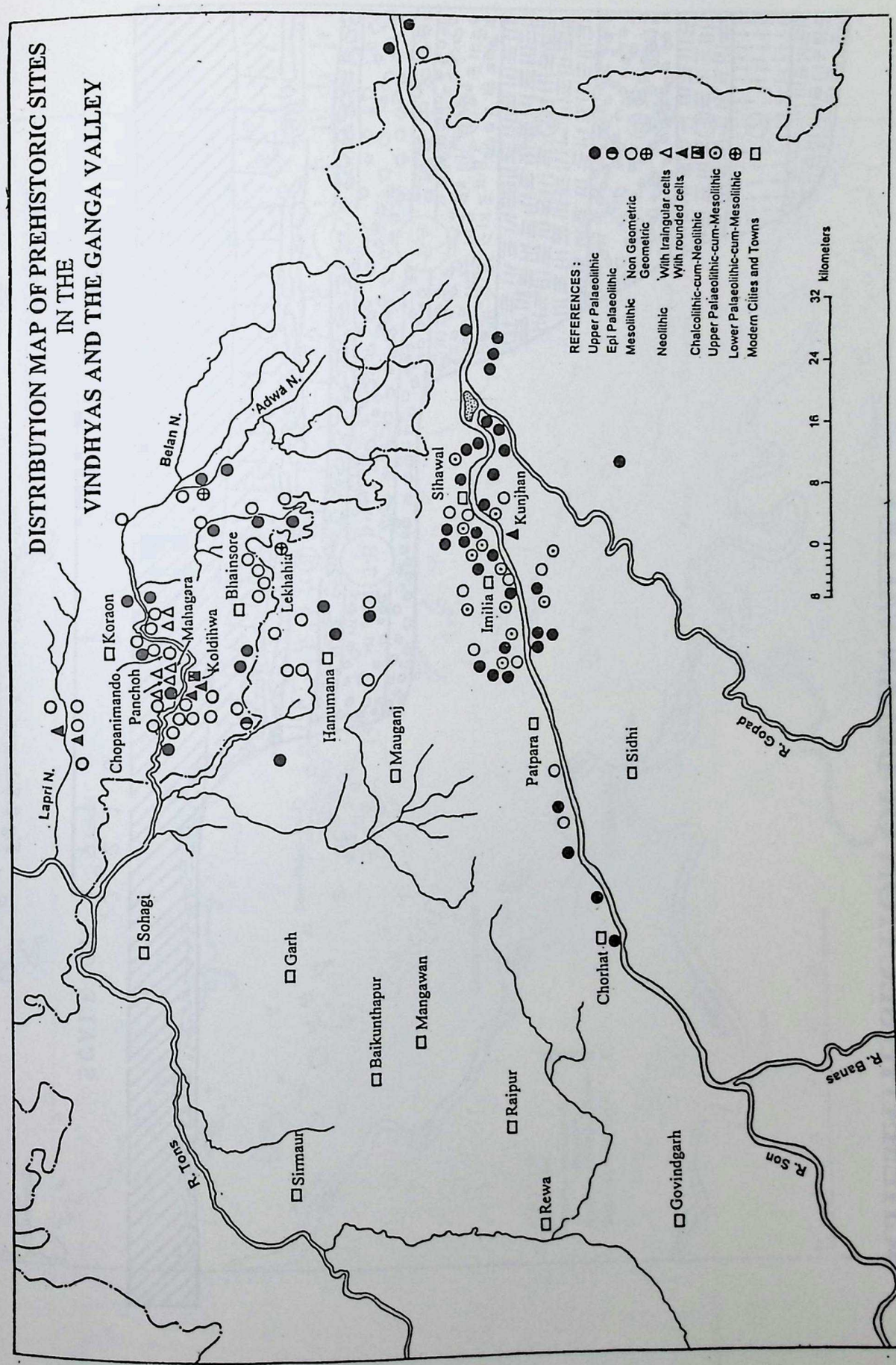

Fig. 1: Map showing the area under consideration with distribution of sites of different periods.

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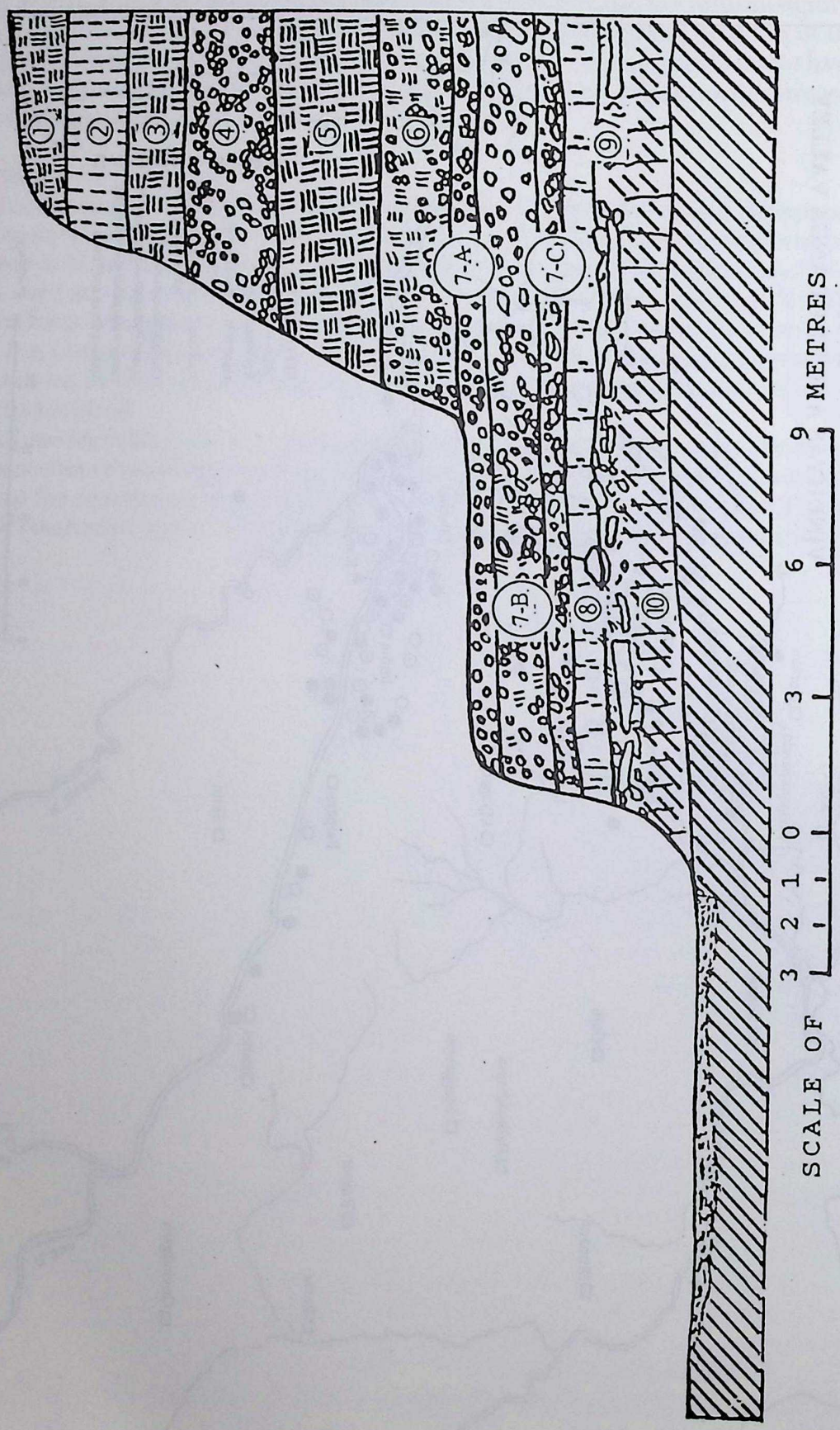

Fig. 2: Schematic Section of Belan Valley.

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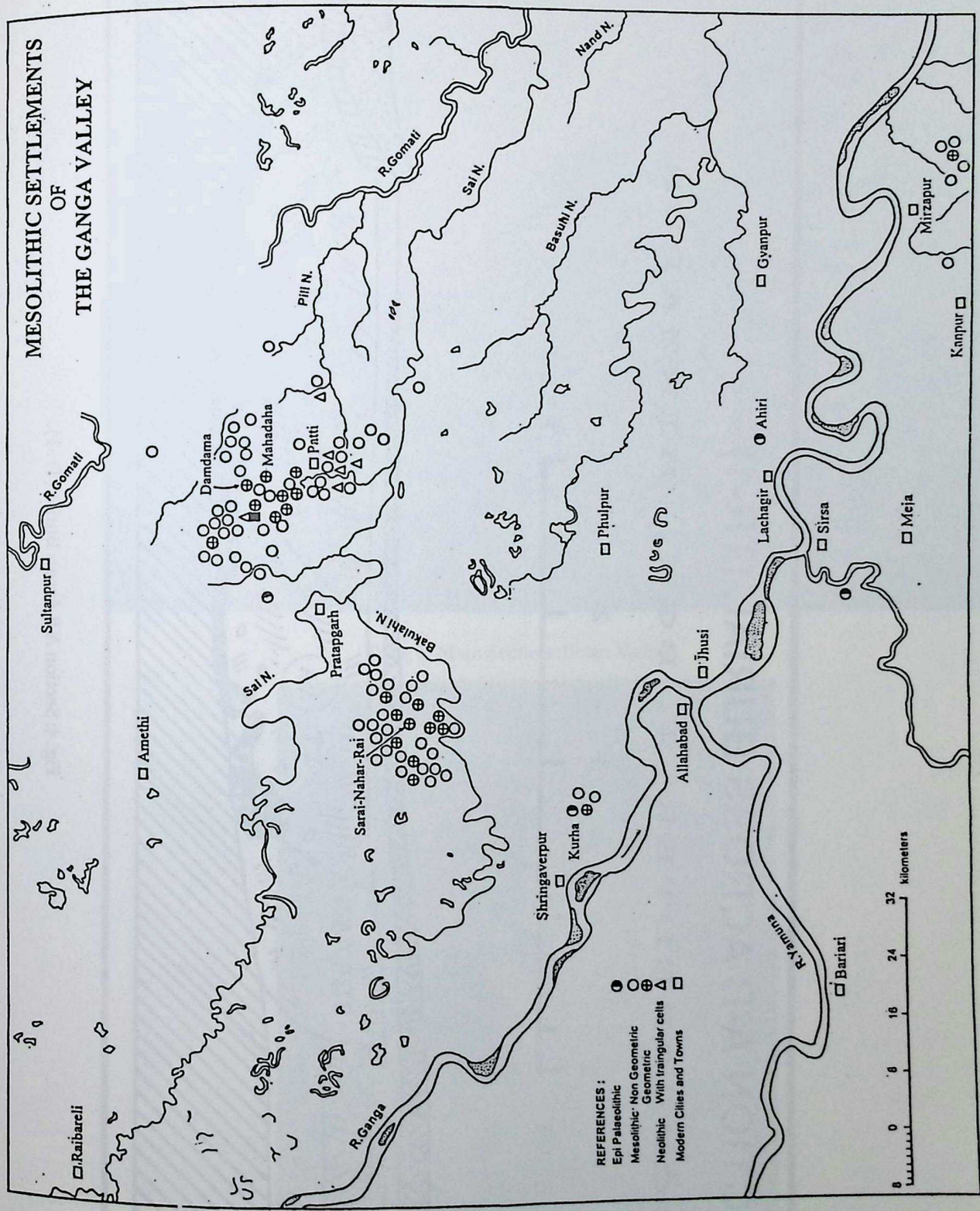

Fig. 3: Mesolithic Settlements of the Ganga Valley.

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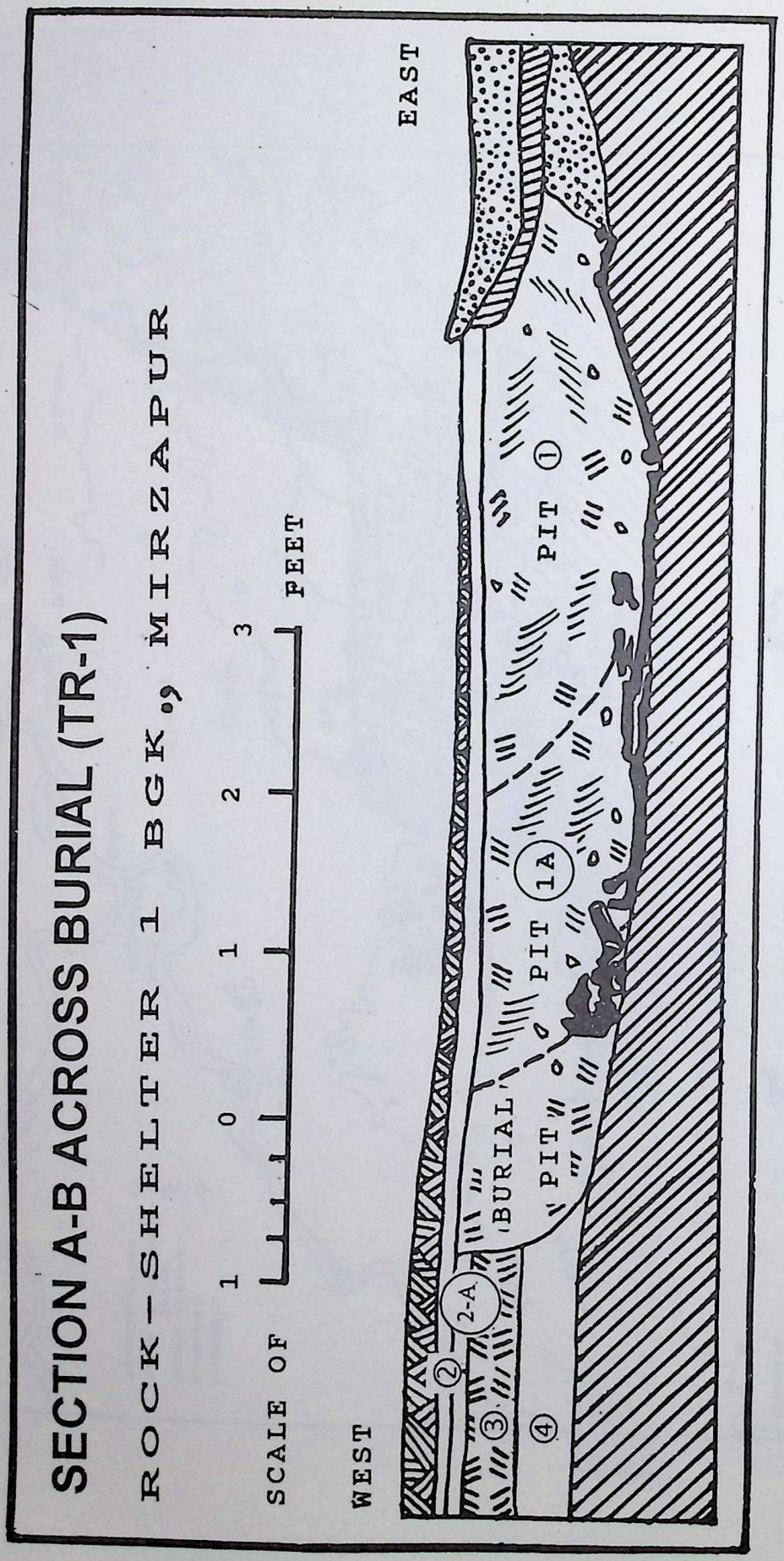

Fig. 4: Section A-B Across Burial (Tr.-1).

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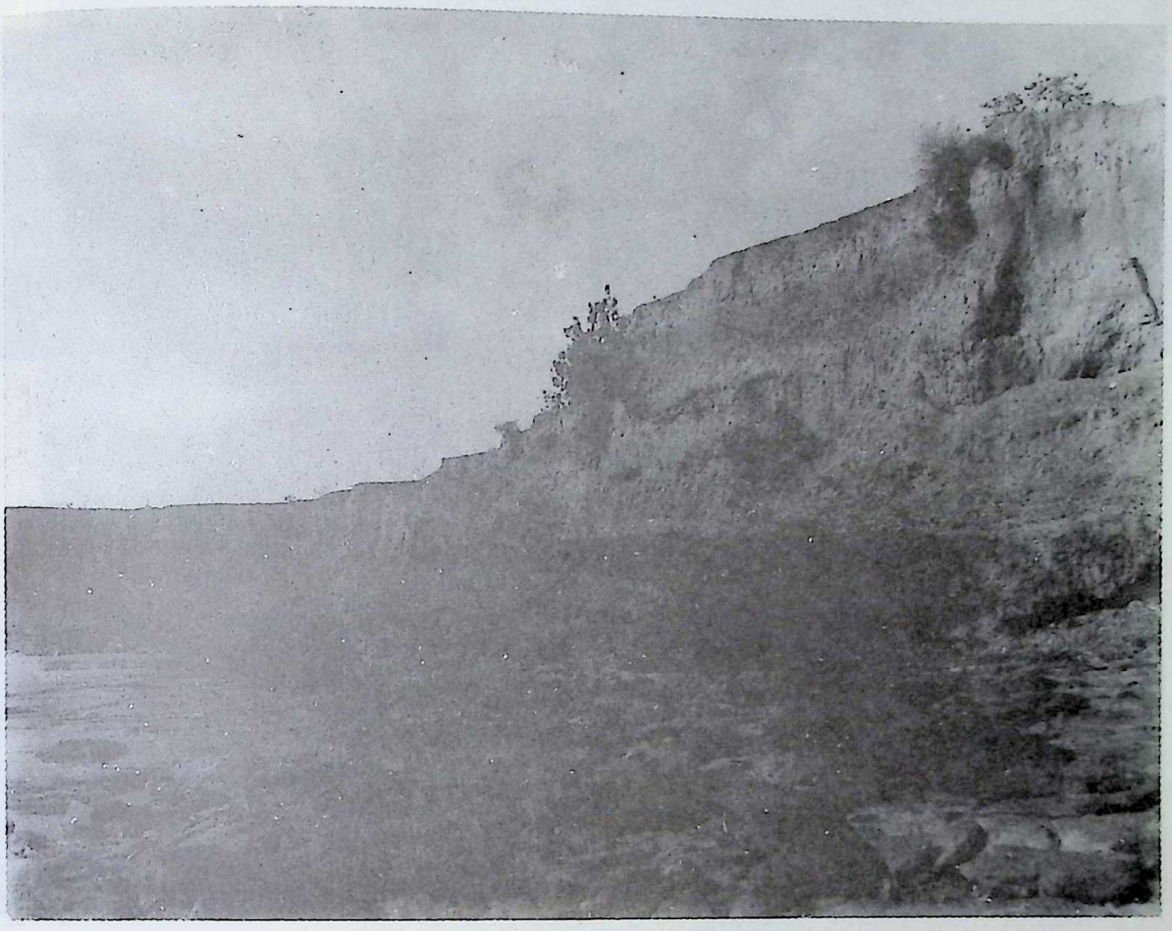

Plate 1: Main Section :Belan Valley.

Plate 2: Fossils from Gravel II, Belan Valley.

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Plate 3: Fossils from Baghore formation, Son Valley.

Plate 4: Patpara Section in Son Valley.

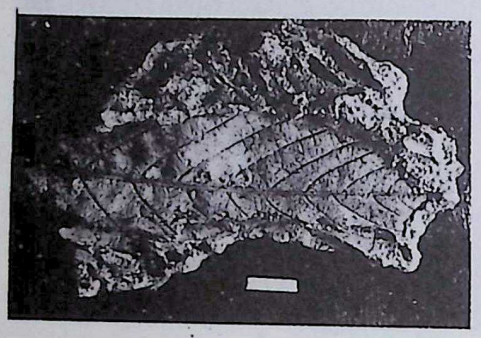

Plate 5: Leaf Fossils, Patpara in Son Valley.

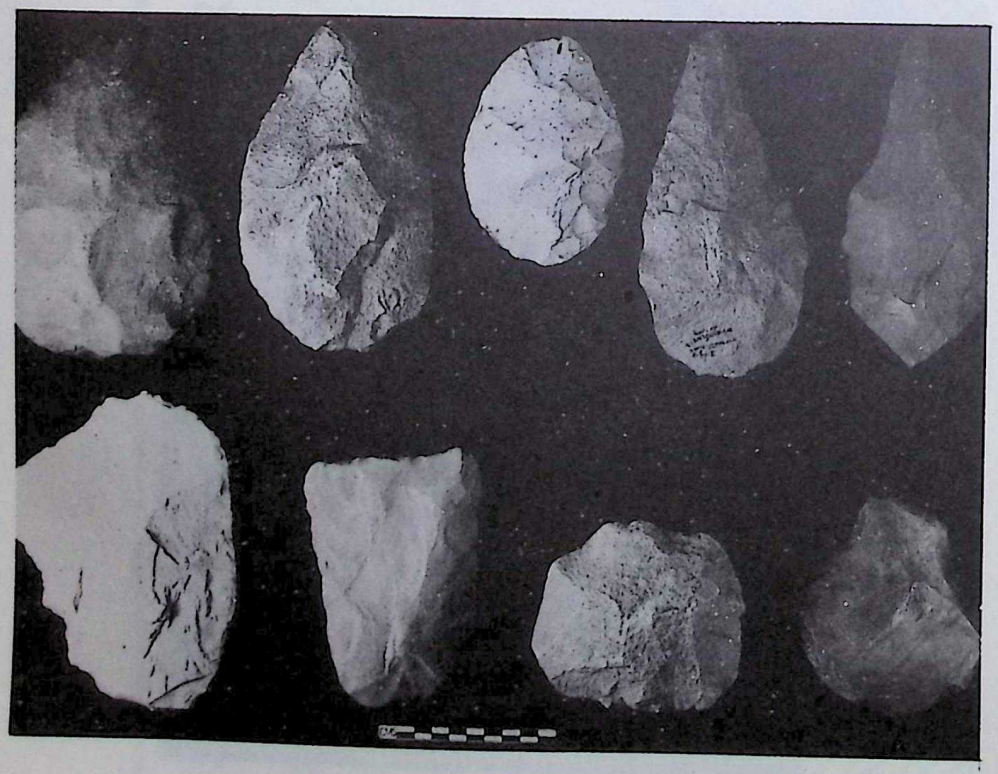

Plate 6a: Lower Palaeolithic Tools, Belan Valley.

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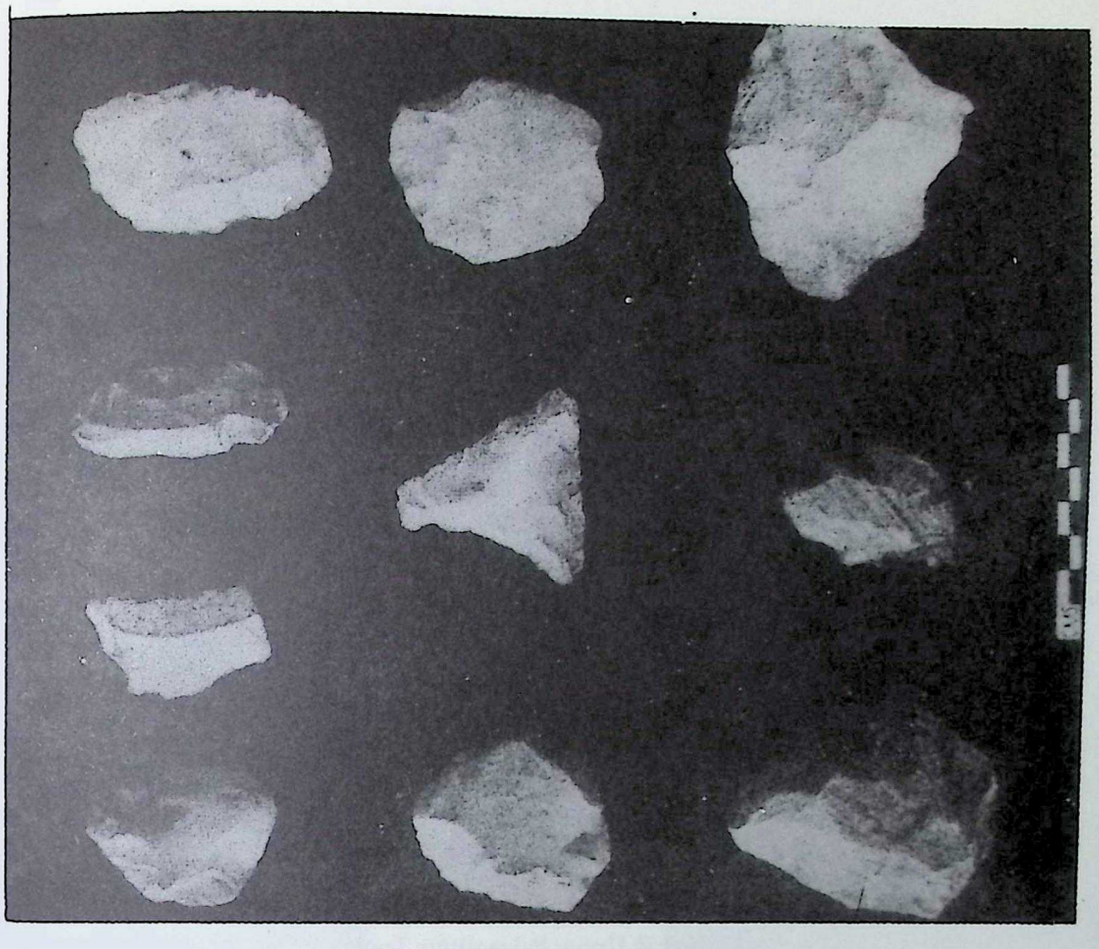

Plate 7: Middle Palaeolithic Tools, Belan Valley

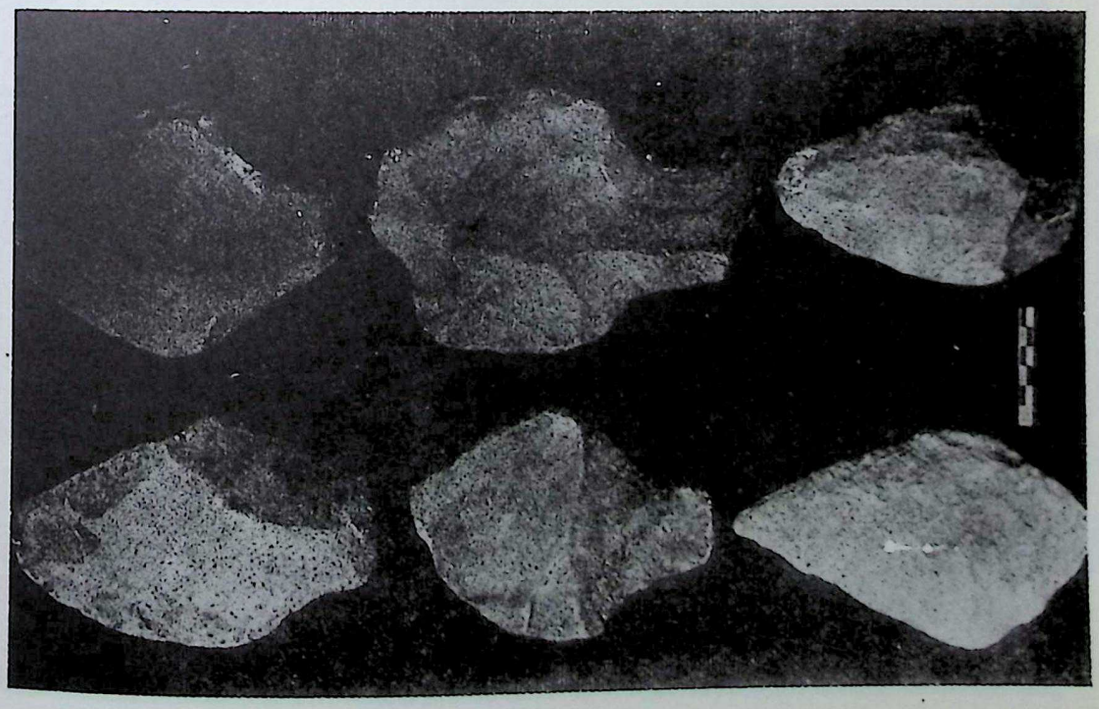

Plate 6b: Lower Palaeolithic Tools, Showing evidence of hafting.

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Plate 8: Upper Palaeolithic Tools.

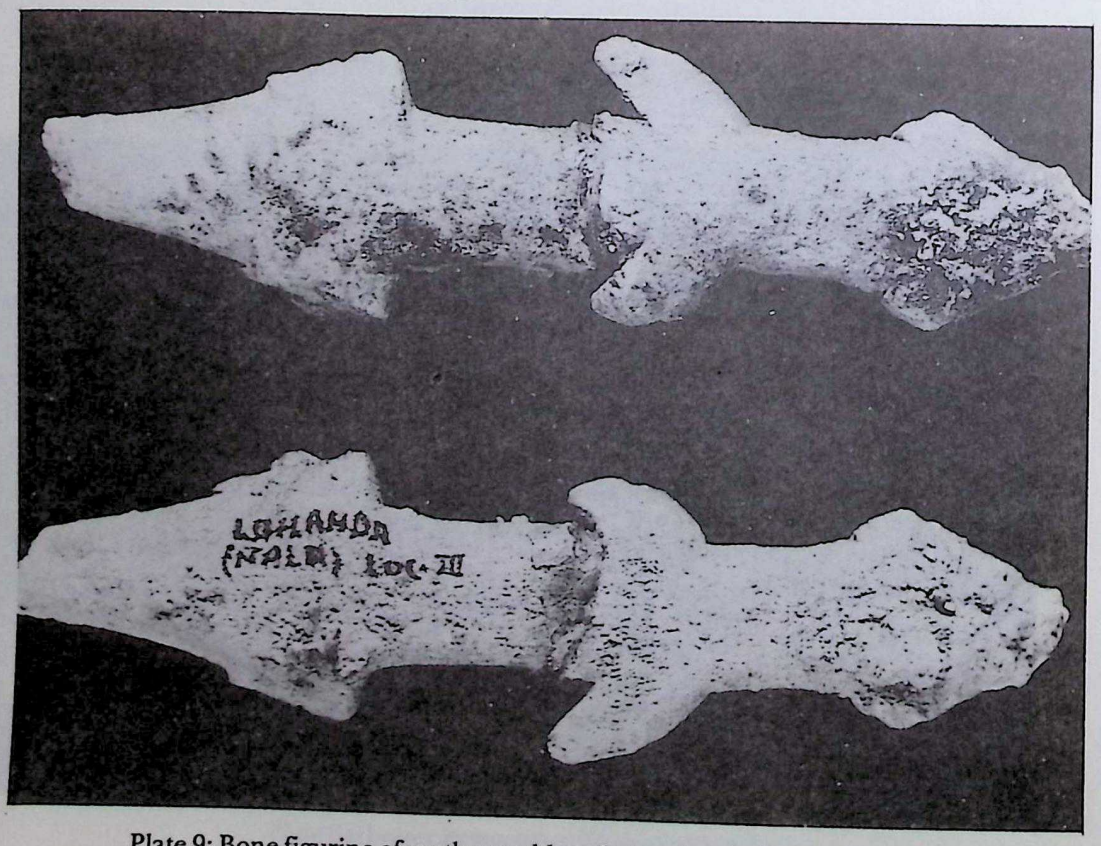

Plate 9: Bone figurine of mother goddess, Lohandanala, Belan Valley.

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Plate 10a: Place of worship, Baghore, Sidhi.

Plate 10b: Object of worship

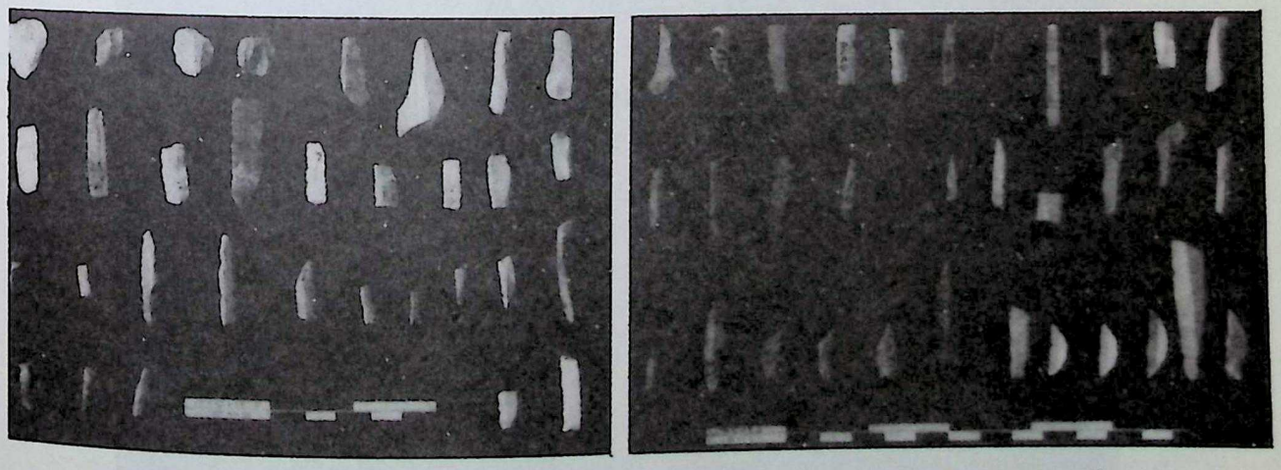

Plate 11: Non-geometric Tools, Mesolithic.

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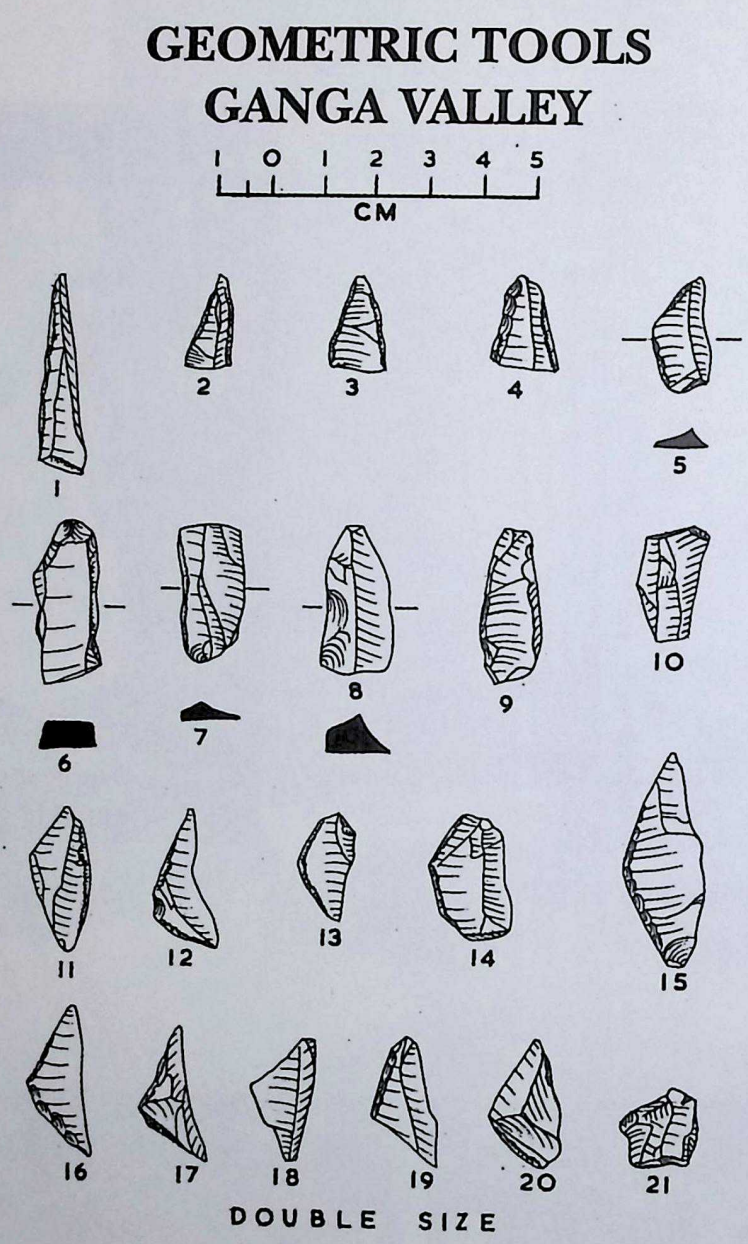

Plate 12: Geometric Tools, Mesolithic.

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Plate 13: Trap scene.

Plate 14: Rock-painting: A group of animals.

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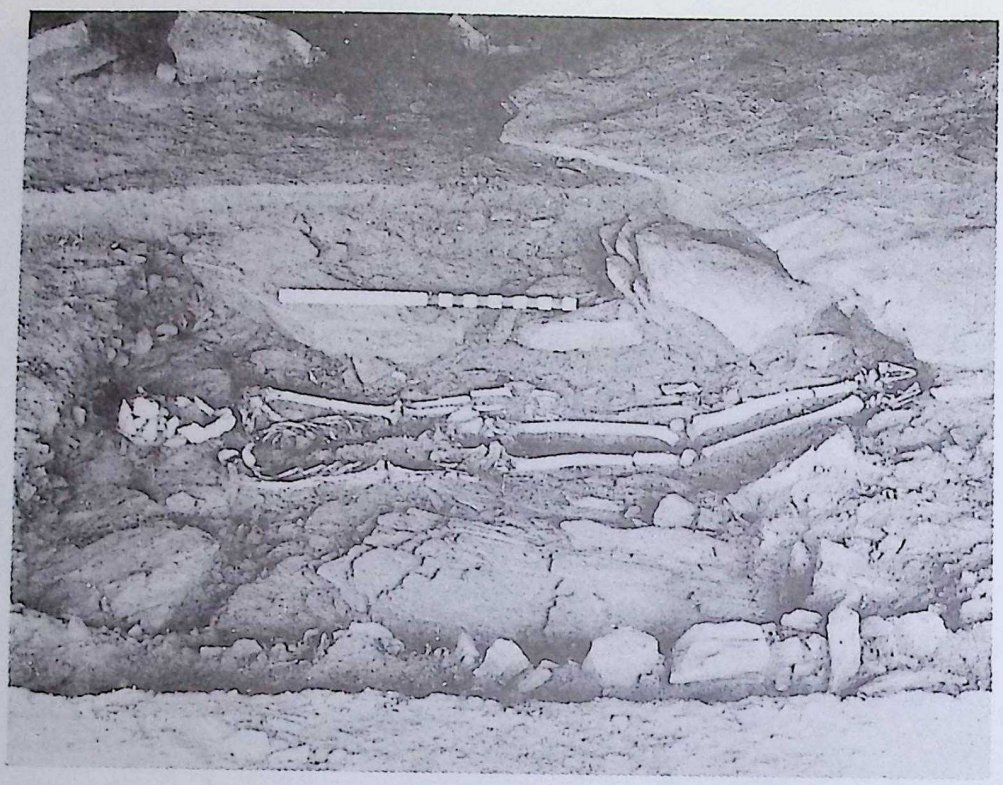

Plate 15: Burial in Baghaikhor rock-shelter.

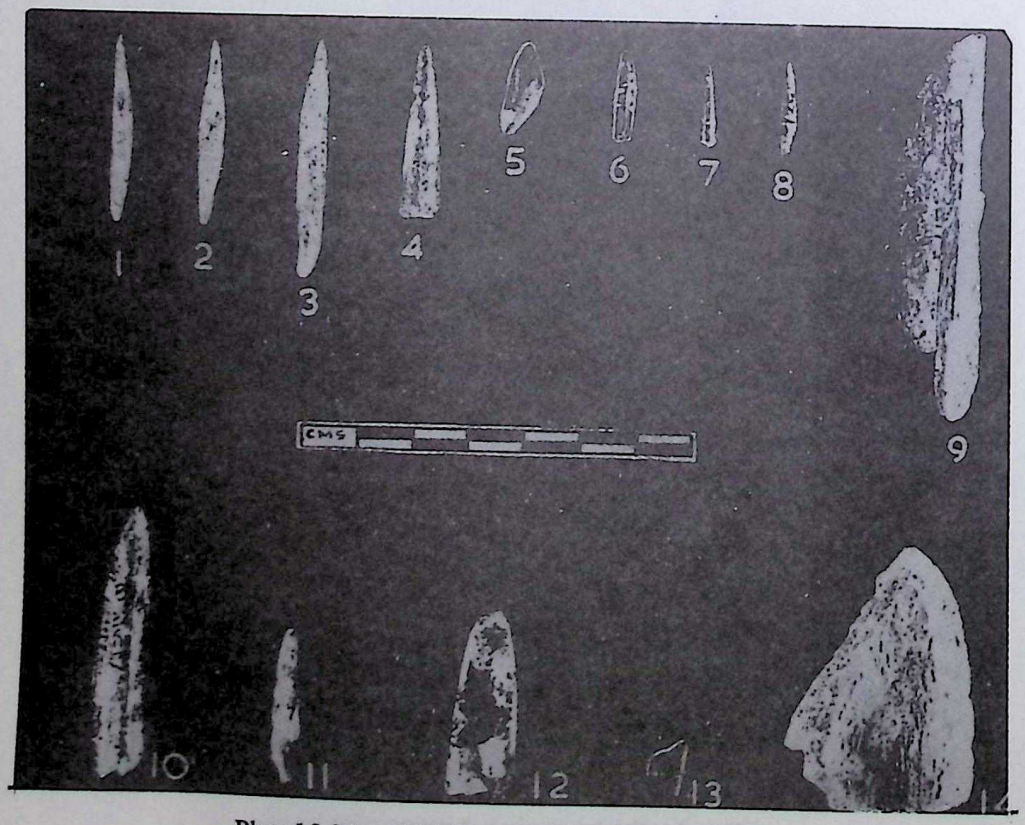

Plate 16: Mesolithic Bone Tools, Ganga Valley.

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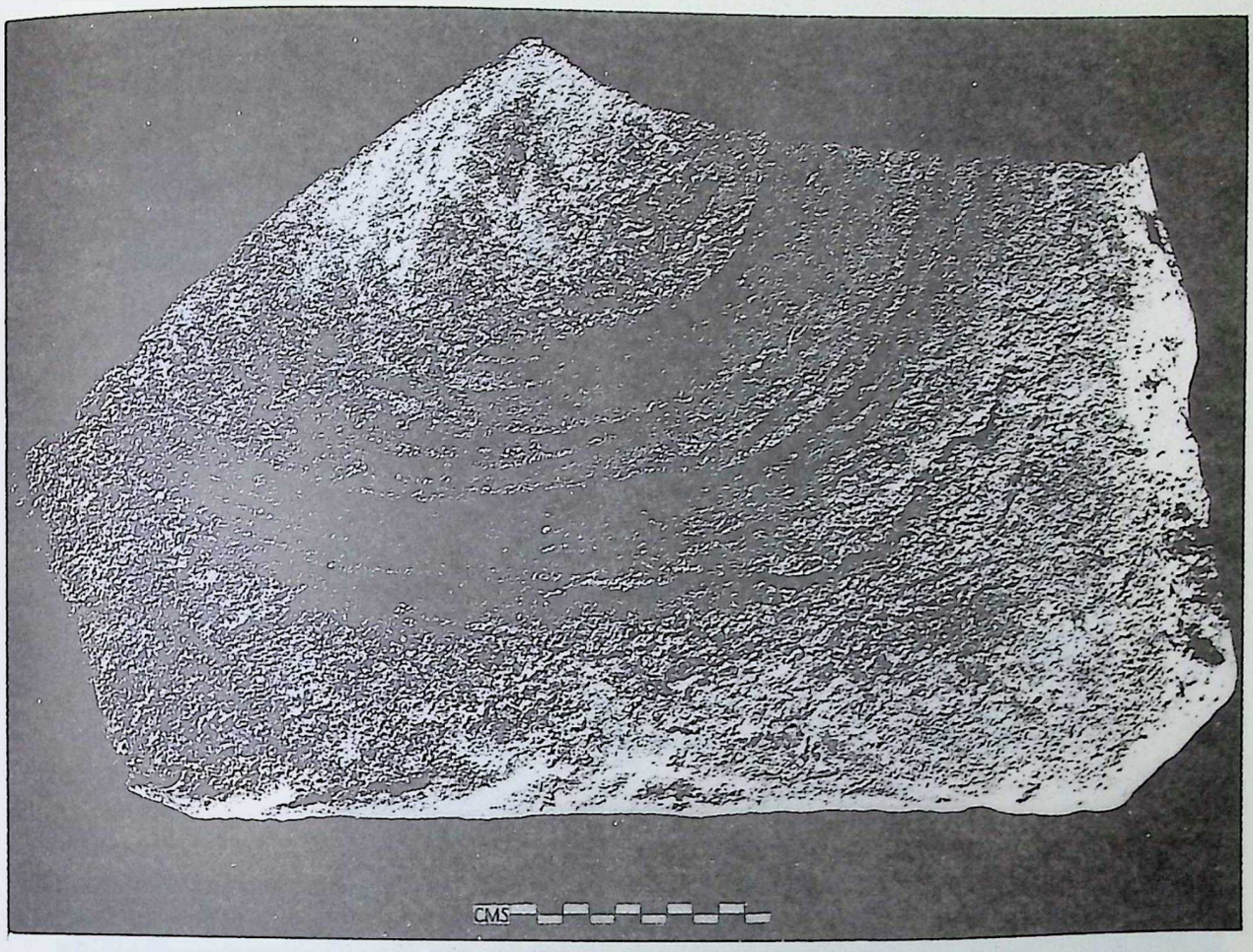

Plate 17: Quern and Mullers, Ganga Valley.

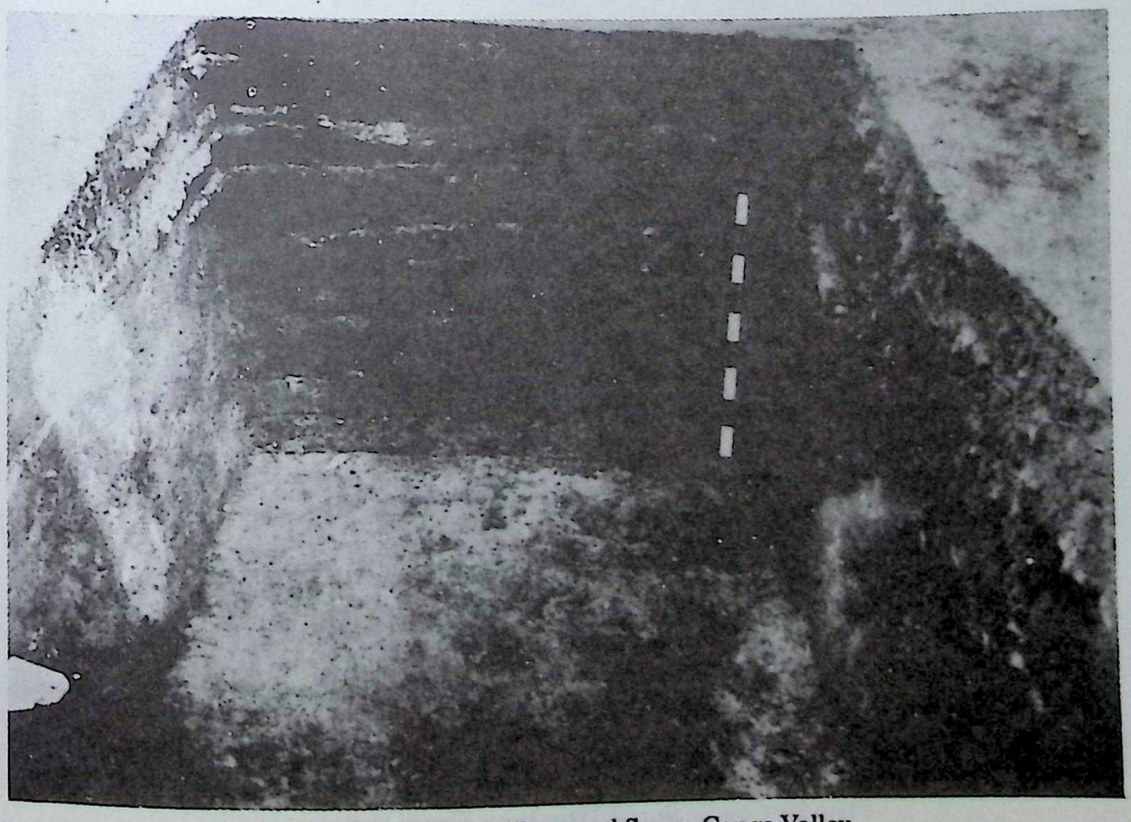

Plate 18: Section of Rammed floors, Ganga Valley.

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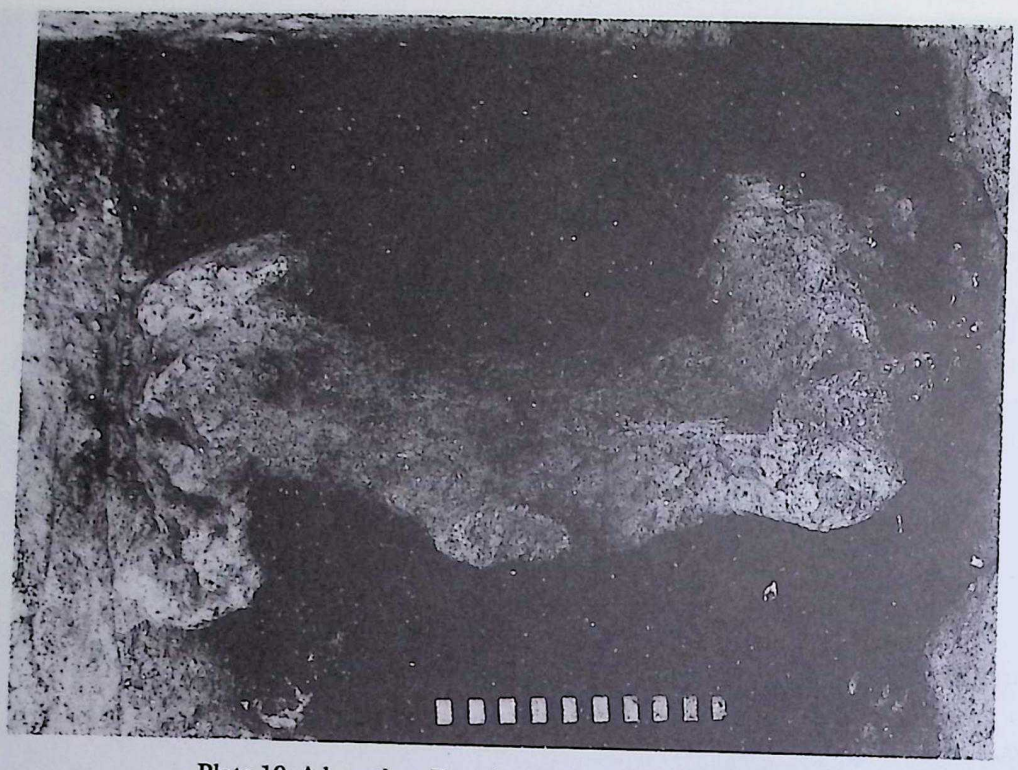

Plate 19: A hearth at Damdama site, Ganga Valley.

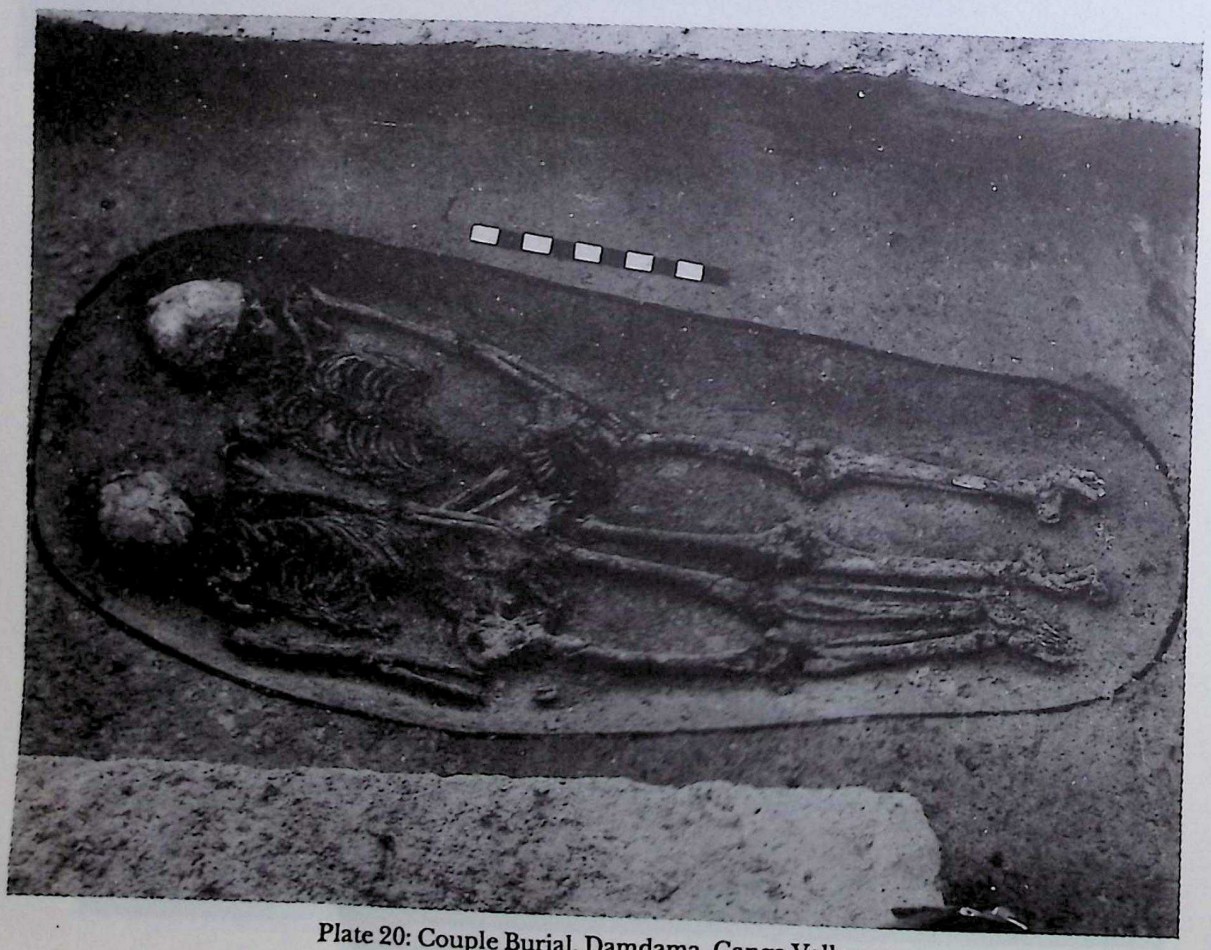

Plate 20: Couple Burial, Damdama, Ganga Valley.

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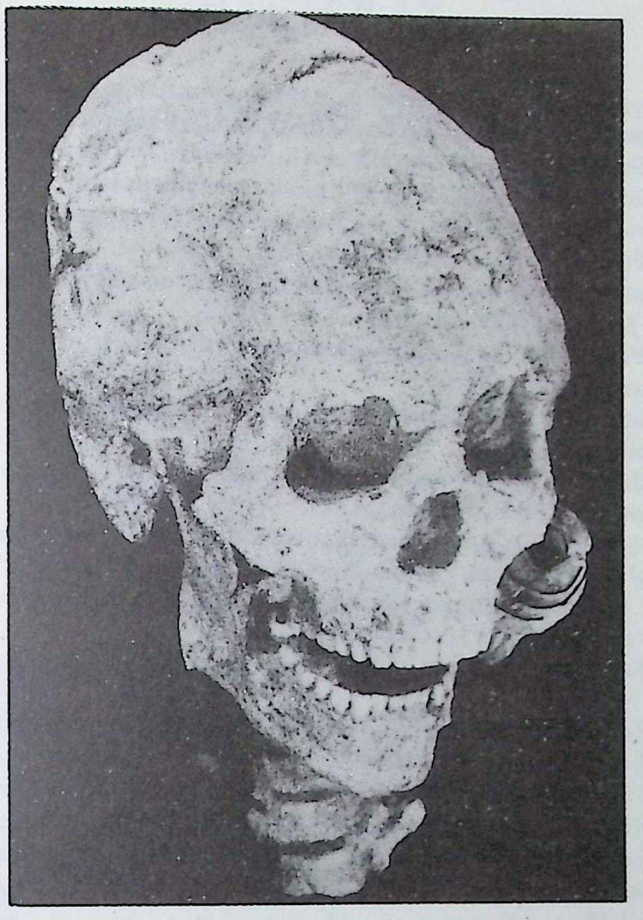

Plate 21: Skull with Ear-rings, Mahadaha, Ganga Valley.

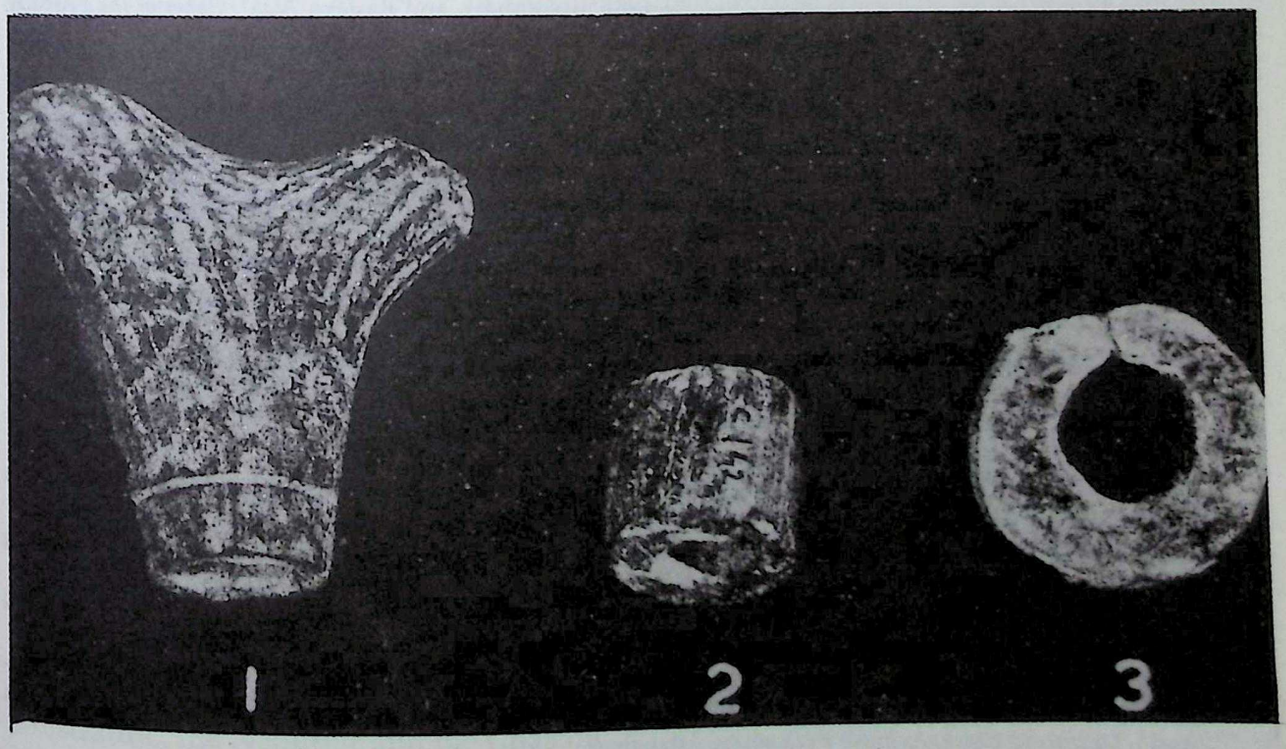

Plate 22: Manufacturing stage of ornaments, Mahadaha, Ganga Valley.

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CHAPTER IX

Cave Paintings of Central India

Sushila Pant

I. INTRODUCTION

Man is a thinking creature and so while he pursues a happy future for himself, he is also driven by a strong urge to know the past. An enlightened person, a person who probes deeply, goes beyond the limits of the personal, the individual, the spatio-temporal to the total man. Such a person goes even beyond this and achieves a consciousness of kinship with all living beings and ponders over the collective and the universal facts. The study of the sequential orders of a cultural tradition is a part of the same endeavour. Perhaps the growing interest in the study of civilization and culture is leading to an increase in the influence of socio-cultural anthropology, archaeology, etc. In consequence of these developments, the pre-historic and proto-historic periods have earned a place for themselves in the domain of history. Since written evidence of the pre-historic period is absent and that of the proto-historic cannot be used, so for the documentation of these two periods one has to depend on stone artefacts, potteries, material remains, caves and cave-paintings, etc. In fact, the study of caves and cave-paintings has emerged as an autonomous sub-discipline within archaeology for critical evaluation of the ways of life of pre-historic and proto-historic man. The literary references to caves and rock-shelters are amply found already in the *Ṛgveda*.[1] Later literature abounds with them. It is not only in the West but also in India, numerous caves and rock-shelters with or without paintings, thousands of years older than the *Ṛgveda*, have been found. For a basic understanding of various aspects of the society and culture of pre-historic times, an analysis of the rock-shelters and cave-paintings is an imperative study.

A study of the caves and rock-shelters the world-over shows that the local environmental factors conditioned their growth and evolution. Variations in shapes and formations are thus natural. Was the main source of cave-paintings in different countries the same or did the paintings evolve independently formed by the varied cultural traditions of different countries? Opinions may differ on these questions. Yet, there is no doubt that leaving aside the regional variations and the minor differences in the representation of the stages of evolution, these paintings have an overall uniformity in character and thus they point towards the existence of a common culture during that period. These caves reflect a continuous evolution of culture from the pre-historic age down to the thirteenth century BC, i.e., up to the historical age. These paintings especially refer to the prehistoric and proto-historic cultures; the Mesolithic, the Neolithic and the Chalcolithic periods. However, it may be noted in passing that in the contemporary archaeological terminology, proto-historic period signifies a distinct culture-period, but in the context of the study of cave-paintings we have used the term

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'prehistoric' to include the 'proto-historic' phase also, from the Palaeolithic down to the Chalcolithic. It is an accepted theory now that the modern man is the descendant of the *Homo sapiens* and it is believed that the modern civilization and culture are the outcome of an incessant struggle for millions of years of that early man and his descendants. The clothes for covering the body, the food for sustaining life and shelter from the rigours of weather have been the fundamental needs of man. However, there was a time when men, like other animals, wandered around naked. With the passage of time, a feeling of shame and decency dawned on him and he started making attempts to cover his body with barks, leaves of trees and animal skin. His response to the two most urgent needs of the early man – food and shelter – were also extremely primitive in form and character. Hunting and gathering were his livelihood and he used to eat flesh of animals, roots and fruit. In the beginning the pieces of stones and that of wood were his implements. Later, as he grew wiser, he began to give shapes to these stones and wood as required. As he wished for more effective weapons, he invented newer weapons like bows and arrows joining together wood, bamboo and thread. Gradually, he became aware of metal and he began to fashion tools out of it but the use of stone also continued. For his dwelling, he made use of shades of trees and caves found abundantly in nature. Over the years, man-made rock-shelters and huts took the place of natural caves. The use of clothes began and so also the domestication of animals. The beginning of agriculture led to the development of the implements necessary for its practice. Carts made of pieces of wood, fitted with wheels and spokes were fashioned bringing in its wake revolutionary changes. Trade and industries soon developed. Yet, the inventions of the succeeding age did not obliterate the practice of the preceding ages. The wooden staff continued into the metal age. Even, at the period, when the construction of huts and houses and the carving of rock-cut caves came into vogue, the practice of living in cave-dwellings did not cease. Of course, new developments very often reduced the importance of past practices. In fact, the extent and volume of the prevalent practices help distinguish various ages and also provide the key to the understanding of the process of dev· lopment. Fortunately, Indian rock-shelters depict various stages of cultural evolution through scenes chiselled, engraved, painted on their walls.

The study of rock-shelters and rock painting started with the chance discovery of the Altamira caves in Spain in 1870.[2] This was followed by a similar discovery in France in 1895 and soon, in 1913, Africa also reported such sites. These discoveries opened up an exciting and interesting field especially with the subsequent discoveries in Australia, Siberia and China. In India also, the work in this field was initiated by western archaeologists, among whom Carlleyle and Cockburn deserve special mention. Both of them simultaneously, but separately, discovered painted rock-shelters in the Kaimur hills of the Vindhyan region. Three years later, in 1883, Cockburn published his findings in the proceedings of the Asiatic Society of Bengal.[3] Subsequently, in 1899, he also published a second paper.[4] Meanwhile South India was explored by Fawcett who also published two important papers in 1892 and 1901 respectively.[5]

In 1910, Anderson started the study of the rock paintings of Singhanpur in Raigarh District in Madhya Pradesh. By this time, rock paintings had become a popular field of study and attracted other scholars also, who tried to open up studies of dimensions of this subject that had not been examined by earlier scholars. Thus Percy Brown analysed the aesthetic value of the paintings. In 1923, Panchanan Mitra dealt with the subject in his *Prehistoric India.* The first independent work on the rock-paintings, Amarnath Dutta's monograph, *A Few Relics and the Rock-Paintings of Singhanpur at Raigarh State* was published in 1931. Manoranjan Ghosh was another Indian writer on the subject. His study was comprehensive and balanced and attained a high standard of critical evaluation that could serve as a model for succeeding investigators.[6]

The study of Indian rock shelters turned a new leaf as Gordon entered the field. He made a deep study of the rock paintings of the region of Pachmari in Madhya Pradesh and published

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a number of articles and monographs.[7] The building of a chronology of the Indian rock paintings has been his most valuable contribution. His methodology of dating the paintings is still used, with some modifications, by art historians even now. One may detect some traces of bias in the chronology that he built, but one must remember that his were the endeavours of a pioneer and bore the natural infirmities of a pioneering venture. Moreover, Gordon's studies were really limited to the region of Pachmari. The methodology that he designed essentially for Pachmari paintings proved deficient when applied to other areas.

The year 1933 marks the beginning of excavation of Indian rock-shelters. Hunter, between 1933 and 1935, excavated Dorothy Deep.[8] Bridget and Raymond Allchins placed Indian rock-paintings on the world map. They drew the attention of archaeologists to rock-paintings in their book, *The Birth of Indian Civilization.* The historiography of rock-paintings and shelters would remain incomplete without mentioning V.S. Wakankar. He highlighted the indigenous elements of these paintings and provided a new insight for future researches. Wakankar's extensive field work raised studies of painted rock-shelters to new heights and his writings brought them international recognition as sites of great archaeological significance. Credit goes to him for popularizing the study of Indian rock-paintings in India as well as in the western world. Following the model of Hunter, he excavated Modi and other sites. Gradually, thanks to his efforts, there grew a new awareness of the importance of the field.[9]

It should, however, be remembered that both Gordon and Wakankar were at extremes in their dates. Gordon did not recognize Indian rock paintings prior to the historical period. Wakankar, on the other hand, was over-enthusiastic about the Indianness of the rock paintings and in his nationalist approach, he advocated a possibly biased antiquity of the shelters. Later, Verma excavated Mirzapur and Khare Hoshangabad.[10] In 1967, Jagdish Gupta produced an interesting work on the subject in Hindi, *Pragaitihasika Chitrakala.*

As mentioned earlier, the study of painted rock-shelters began in India when in 1880 Cockburn and Carlleyle heard about a small rock-shelter in Mirzapur, UP. Now, by the end of the twentieth century, such rock-shelters have been found scattered over much of India. These discoveries show that if regional and evolutionary variations are ignored, rock paintings all over India reflect a basic similarity in the different aspects and phases of the cultural pattern in their thematic content and formal rendering.

The rock-shelters are usually found in river basins. Their form depends upon the climatic conditions and available materials of the region. Thus, since in the Deccan plateau, limestone; in the South Deccan, granite and quartz; in Central India, sandstone; and in Andhra Pradesh and Orissa, quartz are available, they naturally had their respective bearing upon the form, technique and the paintings of the rock-shelters of each regions. Sandstone rock-shelters are mainly painted, whereas granite shelters show a fancy for carving and quartz rock-shelters favour engraving. While carvings are rarely found in quartz shelters, the limestone rock-shelters of the Deccan are devoid of painting. Carving was common in Sind, Karakoram, Leh and Laddakh. Thus, the rock-shelters spread all over the subcontinent can be classified on the basis of material and technique. On this basis, five regions emerge: Northern, Southern, Eastern, Western and Central. The Northern Region consists of Pakistan, Karakoram, Leh and Laddakh; the Southern Region includes Karnataka, Andhra Pradesh and Kerala; the Eastern Region covers Bihar, Orissa, Bengal and Manipur; the Western Region includes Gujarat and Maharashtra; and, lastly, the Central Region, covers Rajasthan, Uttar Pradesh and Madhya Pradesh.

Apart from the distinctions mentioned above, relating to form and technique, there are other features also evidencing regional variations. In the Deccan, rock-shelters are numerous; scattered over a wide region, but painted shelters are very few and do not depict much detail. Orissa is very rich in cave paintings of animal figures but is deficient in representations of human figures. Manipur and Bengal are still waiting for detailed spade work.[11] Thus the rock-

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shelters show strong local or regional features. This tendency emerges strongly in western India. If we consider the number, density of distribution and diversity of the rock-shelters, the Central Indian region would appear to be unique in the world. Within Central India also, Madhya Pradesh has a distinctive place in view of the diversity and richness of its rock-shelters.

The Vindhyan region and the neighbouring hillocks of Mekal, Satpuda and Kaimur and the Valleys of Son, Narmada, Betava, Chambal, Ken and Svarnarekha, etc. are the most prolific regions for prehistoric rock paintings. Bhopal and the surrounding area has been considered by some scholars to be the cradle of Indian rock painting. If Mandidvipa, twenty kilometres from Bhopal, is taken as the centre, we would find that the hills in the surrounding region within a radius of thirty kilometres are full of rock-shelters. Thousands of rock shelters and countless cave paintings scattered in this area make it as picturesque as the Milky Way in the night sky. Within this Milky Way[12] is Bhimbetka, a cluster of two hundred rock shelters, painted and unpainted. Wakankar has described it as a Prehistoric Paradise.[13] Madhya Pradesh has numerous other attractive sites.

Rock paintings reflect the story of culture and civilization of the times of their execution. However, they fail to provide answers to questions concerning their date of origin and at what stage of human development the earliest paintings appeared. Despite the best efforts of archaeologists and historians, the date of their origin is still a knotty problem. Earlier, the question was whether they should be dated in the historic or prehistoric period. Now the gulf is narrower: the suggested dating now swinging between the Upper Palaeolithic and the Mesolithic periods. It should, however, be recalled here that though Gordon's dates may be controversial, his approach and methodology are still applicable.[14] The question, however, persists: How can one provide a precise date for the shelters? To start with, the theme, superimposition, tools and techniques were earlier taken as clues for dating. The rock paintings serve us here only to a limited extent, and for their dating one has now to turn to other evidence. Researchers have therefore, sought to correlate the contents of the rock-paintings with other stratified archaeological deposits. The excavations at the painted shelters of Hoshangabad, Mirzapur and Bhimbetka uncovered tools of Palaeolithic and Mesolithic periods. A few decades ago, excavations were conducted at sites containing rock paintings, near Mirzapur, at Adamgarh near Hoshangabad, at Bhimbetka and other places. These brought to light archaeological remains of the Upper Palaeolithic and the Mesolithic ages. The real turning point came with the excavations at Putalikarara by Pandeya and at Bhimbetka and Modi by Wakankar, who sought to correlate the excavated layers with the paintings. Pandeya also found corresponding features between the painted scenes and the different layers of the excavated materials. This was further supported by findings at Bhimbetka and Adamgarh. These developments have strengthened the hope that the dates of the rock paintings can be established by a careful study of deposits at different levels.[15]

Coming back to the controversy about the question of the antiquity of rock paintings in India, we may consider Wakankar's formulation. He establishes the date of his site on the basis of paintings executed in green pigment. He says that such paintings should be dated up to the Upper Palaeolithic period. This hypothesis is shaky as the lowest limit of the Upper Palaeolithic period is debatable and archaeologists are still trying to define it in Indian perspective. It should be remembered here that the dividing line between the Upper Palaeolithic and the Mesolithic period is not chronologically uniform at all places. It is determined often only by the contrast of geometrical and non-geometrical tools. Wakankar holds that non-geometrical tools predominated in the Upper Palaeolithic period. Interestingly, the Bhimbetka site reports such tools and green pigment from the same layer. This tempted Wakankar to conclude that paintings executed in green pigment belong to the Upper Palaeolithic period. However, this conclusion has been refuted by S.K. Pandeya. He says that colours do not provide a criterion for determining the chronological sequence of a

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rock-shelter. Moreover, there is no uniformity in the succession of colours in the rock-shelters. Some rock-paintings certainly belonging to the historical period are also painted in the same green colour. He concedes that Bhimbetka bears the physical remains of the Palaeolithic period. But he finds it hard to place any of the rock paintings into the Paleolithic phase.

Pandeya discovered a green-coloured stone slab along with a skeleton from trench no. C/26 of Bhimbetka. Radio carbon-14 dates the layer yielding these around 1300 BC. The concerned rock-shelter contains paintings in green colour. Obviously here the green paintings belong to the Chalcolithic period. Pandeya thus thinks that the shelters with green paintings should not be dated before 10,000 BC.[16]

Microliths and the techniques for their manufacture, as depicted in the rock paintings, provide a very broad chronological framework, namely 25,000 BC to 5,000 BC.[17] Upper Palaeolithic man had a fancy for ornamentation. A number of such painted materials testify to this. One may mention here the carved and painted bones from Mirzapur,[18] and the painted ostrich-eggs from Central India, Gujarat and South India.[19] Some rock paintings proved to belong to the Mesolithic age, show the faint traces of earlier paintings on which they were superimposed. Sole or predominant representation of animals is another indicator of antiquity as these are generally considered older.[20] Wakankar agrees with this and considers the layer beneath the huge elephant at Adamgarh rock-shelters as the earliest specimen. The evidence, thus, indicates that rock-shelters in India may possibly be dated up to the Upper Palaeolithic period. In the absence of more convincing proof, one cannot advocate this view more strongly. Whatever may be the case, the fact cannot be denied that the builders of the oldest rock-shelters were food-gatherers and hunters and the paintings mainly delineate the activities of early food gatherer-hunter and his attitude towards life. It seems reasonable to associate these cave paintings with the life style of the Mesolithic period.

Our discussion about the chronology and dating of cave paintings will be incomplete without placing it in a global perspective. Although the Altamira cave in Spain takes the credit for first evidencing rock painting, Africa gets the credit for having the most ancient ones. Hence, the Western notion that Europe was the birthplace of the painted rock-shelter does not appear to be tenable.[21] Indian cave paintings may not be as old and as good as the European ones, they may however, bear comparison with the painted rock-shelters of Spain and Australia. It is usually held that in European rock-shelters the representation of animals antedates the representation of human figures. We find the same dichotomy in India too. In the rock paintings of Orissa and South Deccan, human figures are sparse compared to animal figures. Some magico-ritual symbols such as palm-impressions, severed fingers, and animal masks are found in India as well as in Europe. Despite this, there is a distinct contrast. The Indian painters were keen on portraying heavy, fleshy and curvaceous bodies of animals, whereas the European prehistoric artists were more adept in painting the structural form of the animals conveying energy and vigour. This perhaps tempted Percy Brown to comment that Indian rock-shelters lack the artistic expertise of European rock-shelters. However, despite this, Percy Brown finds Indian rock paintings expressive and articulate.[22] Moreover, they have an indigenous origin. Their Indianness is their most striking feature. Thus, the similarity of styles, between Indian and western rock paintings was not due to borrowing by India but to an interaction of these early cultures. It may also be interpreted as due to some basic similarities of outlook that pervaded the entire prehistoric world.

Prehistoric man painted a very subtle portrayal of himself as the source of indomitable energy. The straight, linear forms of man illustrate this although they show a variation in style. At some places more attention has been paid to the representation of appearance. Although often the details of the face or the limbs are not shown, there are exceptions. In Deccan paintings, man is sometimes shown with both the eyes and legs clearly discernible. Real care has been taken in depicting figures as women. The artists also tried to distinguish between

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man and woman by giving the latter an oblong contour and depicting them as buxom and having large breasts. The paintings reveal that they were the product of a society in which males projected themselves as conquering and domineering. Women are usually shown either nursing children or in scenes of reproductive or sexual activity. Some rock paintings, however, are unusual. They seem to have been painted symbolically, with some human figures depicted in them as if possessing a kind of animal power. There is a steady development in aesthetic sense also. The human figures are not always without clothes now. It is, however, difficult to ascertain the type and trend of dresses and ornaments.

Prehistoric man did not paint merely by instinct but applied his mind to his art. As mentioned earlier, some forms which he created attempt to convey a symbolic meaning. The independent depiction of animals has sometimes been interpreted as the depiction of deities. In Orissa and southern Deccan, there is a predominance of animal figures and most of them have been represented independently and in majestic powerful forms. Except for these unusual instances, the depictions are chiefly of the animals that the prehistoric man hunted. Sambar (*Cervus Unicolour*) deer, antelope, spotted deer, nilgai (*Bos Elaphus Trago Camelus*), wild buffalo, wild boar, etc., occur most frequently. Sometimes rhino, tiger, horses, etc. are also found.

Domestic animals like dogs and humped bulls had independent placing. Some scattered examples of fish, tortoises, bees, scorpions and lizards are also found. Serpents are conspicuously missing. However, some figures have been interpreted as representing serpents (Pl. 10, Fig. 4), but on rather shaky grounds. The only basis for this inference is that, in Australia, such sketchings have been interpreted as snakes.[23]

Rock-shelter drawings also delineate birds like peacocks, ducks and geese. Some unidentifiable birds are also depicted. In Jagdish Gupta's book there is an ambiguous depiction of an ostrich at Pachmari (Pl. 1, Fig. 3). However, Gupta is hesitant in identifying the figure as an ostrich. But archaeological evidences show that the species was not unknown in India.[24] Surprisingly, Irwin's identification gains ground when the survey of the rock-shelters reports findings of eggs of ostrich.[25]

Animals and humans figure more or less in equal ratio in most of the Indian cave paintings. Relatively, the representation of birds appear to be insignificant, numerically speaking. It is interesting that among the birds and beasts only large species are depicted. Presumably, prehistoric man painted such animals as attracted, mystified or scared him or which he found useful. It may be noted here in passing that the term rock painting in Indian context should not be taken in a limited sense. In the rock-shelters the scenes are not only painted but are carved and engraved as well. The term, therefore, covers all types.

Rock paintings may be grouped in terms of the technique adopted and colours used. The pictures are generally painted in flat monochrome, completely or partially filling the figure. Line drawings, sketchy or decorative are also seen. Gradually other styles developed. The paintings do not answer the questions like What, Why or When, but they do make an impact. They delineate their images in natural colours like ochre, red, yellow, green and white. It is not possible to determine whether dry or wet colours were used. The results of enquiries about the techniques, brushing and paints, have also not been encouraging.

We, however, do not question the expertise of the period. Even at this rudimentary stage, the skills of the artists are quite apparent. Representations of men are either painted in outline drawing or in the flat monochrome style; women, on the other hand, are found drawn in oval or rectangular contour. The animals, though they follow the same pattern, depart from the simplicity of the human figures. The outline drawings are used to highlight anatomy and the colours to reveal the internal organs. Surprisingly, we find a successful detailing of internal organs like the intestines, stomach and heart. The most remarkable instance is representation

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of pregnant women or females of other species. A similar transparent technique has been used for showing fish in a net or a rat in its hole.

The tendency towards ornamentation is not stereotyped; there is pleasant diversity. Animals loaded with ornaments deserve to be an independent subject of study. What do these animals signify? Their lively and mysteriously suggestive appearance tempts one to explore further. What was the purpose of decorating these rock-shelters? Was it an outcome of superstition, magic mysticism or the religious beliefs of the period? Could it be just the expression of man's aesthetic urges? Answer to these queries alone will not tell us about all the reasons behind man's taking up painting of rock-shelters and cave-walls in the early dawn of civilization. There were also other contributory factors as well.[26] In the beginning man wondered at what he saw all around him. Fascinated, he produced representations of surrounding objects. Gradually he developed his powers of expression and started painting more descriptive pictures and suggestive scenes. They not only delineated his aesthetic sensibility but also his religious feelings and superstitions.

Actually, these innumerable pictures were not painted for one single purpose. Sometimes different pictures together, or sometimes one picture on its own, tend to suggest more than one message. One may take them as representing sensuous feelings or the same may be interpreted as conveying some supermundane concept of the period. We are reconstructing history here on the basis of simple line drawings. Thus, it becomes difficult to interpret whether for example, a picture is just a hunting scene or it carries also a hidden, subtler message.

It would be futile to attempt to explain those pictures from a modern perspective. The fact, however, cannot be denied that they reflect the exciting imaginative journey of mankind. Each and every aspect of life from birds and animals to refined, subtle feelings like anger, enmity, amity and conjugal love are depicted. The study of rock shelters is also helpful in acquiring an idea about the means of livelihood adopted in primitive periods like agriculture, hunting and food-gathering. The dress and accessories worn by the painted figures of later times indicate other flourishing industries.

In Central India it is mainly animal themes that are painted ranging from rhinoceroses and tigers to fish and rats. Individual as well as groups of animals are shown being hunted and killed. The weapons used are made of wood and stone. There are also arrows tipped with metal or spears and microliths. Hunting – the means of livelihood of early man – was fraught with dangers. The problems that he faced while fighting fierce animals made his mind dwell on these and this concern is reflected in his paintings. Hunting was done in a planned and efficient manner. We have scenes of group hunting (Pl. 6, Fig. 1). The strategic positioning of the hunters shows the development of logical reasoning. The hunters used beaters to surround and trap the animals (Pl. 7, Figs. 3 and 4). Animals are shown being attacked from behind or the sides or even from the front (Pl. 1, Fig. 1; Pl. 11). A stark contrast may be seen in the display of the technique of fishing with a net or trapping rats in their holes (Pl. 2, Fig. 1) projecting the skilled use of ingeniously devised equipment. An interesting scene from the Son Valley, Mirzapur indicates the techniques followed while fishing the aquatic animals. The scene depicts people in a boat spearing tortoise or fish (Pl. 1, Fig. 2). The other side of hunting is also effectively shown. A Bhimbetka burials depict (Pl. 2, Fig. 3) hunters being tossed up by a rhinoceros. The scene has effectively caught the terror among the other hunters. Cheebar Nala has the depiction of a scene in which a tiger is seen attacking one of two hunters, while the other is aiming an arrow at the beast.

With the passage of time the tendency towards adopting more skilled methods was coming to the surface. Now, hunters are shown wearing animal masks and skins. Usually, these pictures have been interpreted as signalling occult practices. This interpretation raises the following queries: Was this the beginning of esotericism? Did the painters want to convey

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something extraordinary or was it just a simple hunting scene? Some scenes really need a broader analysis. Thus, the dwarfish appearance of the hunter (Pl. 1, Fig. 5), or the depiction of a boar with a man underneath (Pl. 1, Fig. 6) have been taken as suggestive of primitive religious symbolisms. Such significant depiction may also be the prototype of the boar-incarnation of the Hindu mythology. These suggestions may appear tempting, but they cannot be confirmed in the absence of decisive evidence.

Although women are also shown in hunting scenes, they are never shown as part of the active hunting group. They stand aloof with digging sticks. Some sort of division of labour may be visualized: the women were involved in the gathering of vegetables and fruit and the men obviously took the responsibility of bringing in the meat.[27]

Besides hunting, domestication of animals and agriculture were also emerging. It was only the beginning, as these professions were not yet very widespread. A humped bull being dragged or a bull being yoked to the plough (Pl. 10, Fig. 3; Pl. 7, Fig. 2), a chariot drawn by four bulls (Pl. 2, Fig. 2), and load bearers carrying loads hanging from poles or shoulder straps (Pl. 6, Fig. 2; Pl. 5, Fig. 1), give only faint glimpses of these prevalent occupations. It seems that these scenes, which are only a few are not carefully drawn. Moreover, from them the technique used for these activities cannot be ascertained, though the rock-shelter paintings do portray several other trades. The use of arms, weapons, ornaments, buckets, nets, vessels, musical instruments, carts and boats is evidenced by the paintings. The basic questions, however, about the techniques used by their authors remain unanswered. How were clothes, nets, buckets or vessels made? How were boats or carts constructed? The making of wheels for carts must have been a break-through. Presumably from among the hunters and food-gatherers specialized skills and enterprises as those of potters, carpenters, weaver, and metal workers emerged. This clearly indicates a slow but steady sprouting of different professions. It was the same hunter or food-gathering man who had now become more enterprising. It obviously led to a more convenient life. Thus, the invention of the wheel provided a faster cart. This is, however, a hypothesis that encourages further researches. At present, we cannot confirm it definitely. Alongwith the development of the means of livelihood and technical resources, the earlier rudimentary depiction of man, animals and birds became subtler by the depiction of their attitudes and instincts. The struggles with wild beasts and domestic animals are skillfully shown. At Singhanpur the confrontation of two fierce animals is shown between frightened men (Pl. 8, Fig. 11).

There is an indication that man was becoming aware of his supremacy and his strength. Elementary groups came to be formed and, with them, the concept of leadership. The paintings also depict very vivid and interesting scenes of fighting with stone weapons (Pl. 8, Fig. 2), microlith or metal-tipped arms (Pl. 10, Fig. 1), and axes. Wrestling and boxing (Pl. 11, Fig. 3) are also depicted. Such scenes may not always imply enmity. They could also be for entertainment, as among pictures of festive processions wrestlers are also included (Pl. 6, Fig. 2). Surprisingly, among all these fighting scenes, nowhere is a dead body shown. Very rarely is a human shown lying under an animal. It marked perhaps some sort of ceremony connected with death or sorcery.

Scenes of domestic, conjugal or sexual life are not very abundant in the painted rock-shelters of India. The reason may be sought in the then circumstances, when the top priority was the day to day struggle to collect food. Thus, the limited, though uninhibited, portrayal of domestic and erotic scenes. The frank depiction of sex indicates the openness of the culture of those times.

The significance of such scenes can hardly be overlooked. Though very few in number, they are bold and blatant. They very competently depict the man-woman relationship. A painting from Kathautia (Pl. 9, Fig. 1) very effectively portrays domestic life. The scene is not limited to a single household but covered a community of houses. A number of women are shown engaged in household work. Some paintings, showing women dancing, are really

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impressive. The depictions of amorous couples show that the period did not lack in refined taste. A picture of a mother feeding her baby is most impressive, and appeals to both layman and connoisseur. It also marks the beginning of family life. Lakhajwara exhibits a couple taking a meal with their child. They are eating out of a dish and a pot for water is by their side. A pregnant woman is shown in the transparent style (Pl. 3, Fig. 1). The paintings very vividly narrate that it was still a sexually uninhibited society. In Arden, intercourse is shown under a deer in the midst of other people and animals (Pl. 3, Fig. 2). Some paintings possibly display scenes of molestation. Homosexual scenes and ithyphallic human figures have also been found depicted. Among such paintings mention may be made of those at Javara and Kathautia (Pl. 4, Fig. 3). Even animals like boar and ox are depicted like this (Pl. 4, Fig. 5). In Kathautia, there is a rare scene of masturbation and of two rows of ithyphallic figures, and of a man holding a 'lingam' under a bull. Does it symbolize 'linga' worship?

Some cave paintings depict festive scenes. Attempts have been made to connect these with magic and ritual. Some dancing postures seem to be gestures of appeasement addressed to an unknown power. We may cite here a painting from Modi, where what might be an Altar is decorated with animal-heads and is surrounded by dancers.[28] The suggestion that this is a depiction of a magical ritual appears to be uncertain. It can also be interpreted as a dance celebrating a victory. A similar scene from Kathautia in which men are dancing around a dead boar, strengthens this view. The Kathautia depiction (Pl. 12, Fig. 1) is enigmatically enchanting; that at Lakhajwara (Pl. 7, Fig. 1) is much more lively with the rhythm, balance and movement coming alive in its subtle lines.

Rock-shelters were no doubt painted out of magico-ritual urges. Man's fear of the mysteries is a universal phenomenon. In the hoary past, man's curiosity concerning as well as his fear of the unknown, were at their peak. He was both fascinated and scared by his surroundings. He had two options to overcome his fears: either to surrender to it or to conquer it. The rock-shelters under study very successfully depict the exercise of both options. Thus, the traditional view that man's actions were influenced by occult practices and the latter were the outcome of man's actions is supported by the Indian evidence.

The rock-shelters themselves look like places for performing rituals. Some scenes painted in them are so mysterious that they are obviously the outcome of these practices. Here also, we come across prints of palms and severed fingers. Witchcraft is still prevalent in modern India and such practices are still encountered (Hind, p. 20, 21). Similar imprints have been found from Banda (Pl. 9, Fig. 2). Their purpose cannot be ascertained by any speculation. Though the art is provocative, it has always been approached subjectively and thus interpretations of it are always biased. From Shamla hills, we get heavily ornamented masked man painted. He is surrounded by five stags and two wild buffaloes (Pl. 5, Fig. 2). It can be interpreted either as an ordinary hunting scene, or as depicting some occult ritual.

Clearly, animals loomed large in the life of the people. Pig, boar and some fantastic animals had already gained a niche and were painted as if they were deities (Pl. 1, Fig. 5&6). It is this that perhaps led Irwin to presume that a cult of boar worship had developed there and that this signified the beginning of religious awareness.[29] A boar is offered a meal at Kathautia (Pl. 4, Fig. 2). Can this be taken as the seed of the later mythology of a boar incarnation? Later, economic requirements established the divinity of the bull (Pl. 11, Fig. 1).

From Lakhajwara is reported a painting of a man with horns and an animal mask holding by the neck a bull with six legs. A number of horned men are shown among the dancers. A bull is being fed and a boar is also shown. Some symbols like Swastika and Trident occur. Similar scenes have come to light from Chambal and Chaturbhujnath. These scenes have been taken as the antecedents of later developments. Even the Hindu view of crossing the Vaitarni after death has been said to be depicted here. The Shamla rock-shelters at Bhopal portray women, a water carrier, two men with bows and arrows on a humped bull. In the most

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significant part of the scene a man is shown holding the tail of the bull. Was this a sort of pilgrimage? Could it be the discrete form of the Brahmanical belief of departure to the yonder world?[30] It should be mentioned here that Irwin identifies the object before the bull as a honeycomb. This is not justified. The scene was painted by a farmer of the Chalcolithic period. Hence, it could be a feeding pot. Even now, in the orthodox tradition, an animal is fed well before the ritual of Vaitarni. It would not be totally implausible to posit the view that the tradition had its beginning in a crude form in the prehistoric period. Such scenes were also found from burial 11 of Harappa and the Bhimbetka burials of the Chalcolithic period are well known. It could of course, also be a simple representation of the taming of animals.

In some of the scenes the message is rather ambiguous. Phirangi shows people lying under a wild boar (Pl. 1, Fig. 6) and another uncommon painting from the Gaser caves (Pl. 3, Fig. 3) can be cited here. It depicts a peacock resting over a crouching man and an elephant beside him. This ambiguous representation is really perplexing. It may be taken as showing some ancient myth the significance of which is no longer known.

So far as the ornamentation is concerned, there are two types. The profusely decorated animals show a fancy towards ornamentation. The independent mysterious decorative motifs convey an impression of human intelligence. In Jawara, a square figure with line drawing decoration has been found. The square tends to be a circle. The top of the motif is painted with aquatic plants. Near their roots, fish are shown and birds are shown flying at the other end. Irwin thinks that it was the first attempt at expressing a vision of the universe. It is difficult to agree with him as the diagram itself is not very explicit. It is not clear whether it was a layman's drawing or an expert's creation.

The world of vegetation had equally mesmerized prehistoric man. It had both utilitarian and sacred value for him. Though vegetation and flowers are not present profusely, in their small number they are impressive and eye-catching. Flora did not terrify struggling man, but still he bowed before their majestic forms. In Monteroza, we find a blooming tree being worshipped by four persons (Pl. 4, Fig. 4). Jagdish Gupta holds that it signifies some magico-religious belief or tree worship.[31] We should however bear in our mind that there cannot be one single reason for it. Adamgarh, on the contrary, exhibits an appealing picture, where an ochre-coloured man is holding a metal-tipped arrow and a bunch of flowers in the hands (Pl. 4, Fig. 1). Perhaps it is a delineation of natural power as a deity. The deity of the forest appears to be represented here, giving the impression of the beginning of the personification of the deity.[32] It may also be recognized as the first step towards idol-worship.

It will not be deviating from the point if we discuss here the depictions of pregnant women. It could be the portrayal of the mother Goddess and fertility cult. Significantly, in the western world, such a depiction has been taken as both. The Indian counter-forms may not be different from it.[33]

Whatever the precise facts, it is clear that man has now started worshipping an unknown power which regulates this world. Did this herald worshipping of God in images of man? The available evidence does not strongly suggest that it did. The depiction of human chains has usually been taken to indicate cult rituals but the depictions may just as well signify the evolution of a sense of community, a memorial dance, a hunting or, above all, an auspicious symbol.[34]

Not all the motifs depicted in the rock shelters are vague. Some drawings are of forms which are not only distinct but also universal. Thus the Chakra and Swastika not only connote religious beliefs but also rituals. Their inner significance may be the same everywhere. Even in Europe the meaning of such symbols is shrouded in controversies.[35] The Swastika is usually shown in a plus sign. Depiction at Vaniacheri and Singhanpur deserve mention here. Sometimes it has been sought to be associated with serpent worship. Undulations on its left in the representation of the Swastika at Vaniacheri could be taken as representing a serpent.

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This could be true for some other parts of the world, but the Indian rock-shelters are definitely devoid of serpent worship scenes. The suggestion, therefore, becomes doubtful in the Indian context. The Lakhajwara Swastika not only looks like the auspicious Swastika, but also like a trident. Initially this led to the belief that the trident was evolved out of the Swastika. This was later contradicted by the depiction at Singhanpur, where both symbols appear.

The rock-shelters of the Indian subcontinent portray hunting and food- gathering scenes and the wits and aptitudes of Mesolithic man. However, it is debatable whether man started domestication first or agriculture first. Generally, archaeologists consider that domestication antedates agriculture. Gordon Childe however, does not agree with.[36] Nevertheless, the fact cannot be denied that they both gave stability to hitherto nomadic man. He learnt to live in a community or independently outside the sheltered world of the rocks. Thus, his emigration from the rock shelters also marks the gradual decline of rock-painting. It does not necessarily mean that by the end of the Mesolithic period man had said farewell to rock-shelters. Pachmari and Bhimbetka reveal marks of habitation from the prehistoric to historic times. Not all the rock-shelters were continuously used. Thus, the Singhanpur rock-shelters were abandoned after a single cultural period. Mobile man kept changing his place of residence in search of his livelihood and, wherever he stayed, he left behind traces of his life-pattern. The aptitudes, aestheticism and the struggle of man of that period had a bearing on his paintings. Most of the rock-shelters were used as abodes and very few only for rituals. There is no unanimity on whether man really lived in these shelters or only used them for artistic expression or religious rituals. Thus, Shanker Tiwari raises the question of the absence of smoke in these shelters.[37] He says that the builders of these shelters never actually lived in them. They stayed rather in nearby villages. This does not seem true especially for the rock-shelters of the Mesolithic period. The Mesolithic paintings display only the life-pattern of the food-gatherers and hunters. Moreover, early rock paintings do not generally delineate a village or community life. Certainly huts were not unknown in that period, but traces of settlements are not found near all the rock-shelters. Moreover, man occupied with unremitting challenges of existence, could not have had scope for going to the remote shelters with brush and paint for painting alone. Thus, the evidence tends to indicate that the painters who were hunters and food gatherers were inhabitants of the caves they painted. It is true that the absence of smoke is a serious indicator to the contrary. Presumably, man did not burn fires inside the caves.

The story of mankind shows that man and his life are both conditioned by environment. This is a universal truth for all the stages of human development. Man's responses to the changing situations are very strongly expressed through his paintings. Gradually, he learnt to conquer his surroundings and the hunter and the food gatherer became farmer and cattle-rearer. His nomadic habits gradually waned and he began to lead a settled life. Even in this process a small number of food-gatherers and hunters remained unchanged. Classifications and periodizations in the history of civilization are based on general characteristics. A period is named after these special general features. In the Palaeolithic and Mesolithic periods, hunting and food gathering were dominant, whereas in the Neolithic and Chalcolithic periods, it was agriculture and cattle rearing that were most widespread. The crude stone tools used gradually evolved into tools of polished stone tools and were, in course of time, replaced by metal ones. These changes are reflected in the paintings and therefore, they have also been categorized accordingly.

These paintings very aptly tell the story of the birth and evolution of civilization. The changes in aptitudes and the improvement in human faculties are also reflected here. The microliths, bows and arrows, boats and spoked wheels for carts very beautifully reflect the growth of man's expertise and skills. Thus, the bladeless stick and stone tools signify the first step and metal tools a later, and mature phase, while the bow and arrow may be taken as the

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intermediary stage. Though the early arrow was not metal-tipped but tipped with stone or wood, it nevertheless showed that man had realized its utility. He knew that with it he could throw his weapon much further than his hand or his throw could reach. Now he was better equipped to face challenges. Even a simple device like a bow and arrow was improved to make hunting more effective. Similarly, boats and then the spoked-wheel cart signalled revolutionary steps for primitive man. He was heading towards more scientific methods. The introduction of the chariot reflected sound socio-economic conditions. Development also had a negative aspect. The more civilized man became, the less was he interested in painting his story. With the development of civilization, he became reckless with his brush and paint. Presumably, he had found other more congenial media to express himself. The symmetry and proportion of the Mesolithic period are missing in the succeeding age. Though the Chalcolithic period was an age of agriculture, scattered examples of hunting scenes can still be seen. Such scenes lack the maturity, rhythm and boldness of the preceding age. The Mesolithic scenes are more lively and expressive but now we come across a stereotyped rigidness. Earlier it used to be a hunting procession, now one single hunter is shown killing all the animals. A few symbolic paintings became dominant in the Chalcolithic period. Surprisingly, in the age of the mother goddess, women found only a subservient treatment. They are portrayed as dependents, involved only in domestic affairs, or as object of sensual pleasure. This exploitative treatment comes as a shocking surprise. Perhaps the comforts brought by material development encouraged sensuality in society. The mother-goddess cult represented only a fertility ritual and did nothing to improve the status of womanhood. Ascetic moral values and excessive social inhibition were not yet known. This supposition is supported by the erotic pictures of the period. What is not considered to be in refined taste now could well have been common currency or feeling then. In the absence of any decisive evidence, this presumption may be accepted.

The principal distinct feature of the Indian rock paintings is that they represent the age. They are a general phenomenon of the entire subcontinent, reflecting what might be called the unity of Indian culture. Any major change signalled the beginning of a new culture. Despite the broad unity, just mentioned, the regional features could not be suppressed. Local or provincial tendencies can be seen reflected in the distinct features of the art of each region. It also defines the local culture of that region. This is a fascinating subject and, with respect to rock paintings, Giriraj Kumar has done commendable work. He has tried to trace the stages of development from the Upper Palaeolithic to the Historical period of the Chambal Valley.[38]

In India, it was perhaps due to the influences of the particular region that drawing, painting, engraving and chiselling were individually used in different regions. Thus, in Orissa and south Deccan, animals are not accompanied by humans. In Central India, on the other hand, animals and human beings appear together and practically in equal number. In Orissa and the Deccan, the animals are stouter compared to those in Central India. There is a difference between the human figures painted in the Deccan and those of the Vindhyan region. In the Vindhyan region, special effort has been made in depicting the eyes of the animals, whereas human beings are left without them. The Deccan, on the contrary, shows two legged men with very clear eyes. Such differences were not limited only to the broader groups. In central India, there is a disharmony among the paintings of Raigarh and Mirzapur. Pachmari and Bhopal abound with representations of bow and arrow whereas they are conspicuously missing at Raigarh. Thus, there is subregional variation also. The rock-paintings from Mirzapur very aptly tell the same story of variation. The art of this region of northern Vindhya is different from that of the western Vindhyan area. The Ganga valley, the most significant centre of the economic change during Mesolithic period, appears to have influenced the region of Mirzapur. In this area the later phase of the Mesolithic period reflects

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the progress from the food-gathering stage to agriculture and domestication of animals and has yielded the earliest evidence of pottery and double burials.

The painting, as much as other material remains, reflect this march of people to the early steps of civilization. The entire world of the prehistoric man is depicted here for the benefit of future generations. It shows how development is affected by time and space. The rock-shelters complement the findings of the archaeological world. They delineate a continuity of civilization in India. The folk tradition still retains these features. The paintings shed light on questions concerning the history of man, society, economy, religion, ritual and migrations. They are still awaiting unbiased and alert spade work to enable these silent pictures to articulate the unknown legends of prehistoric man.

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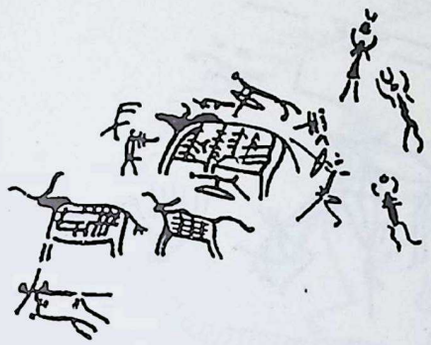
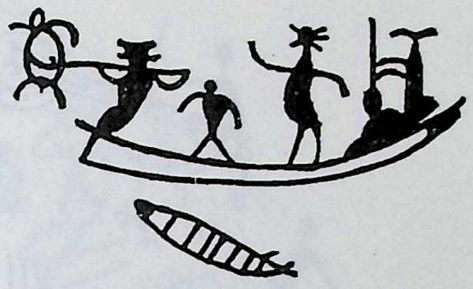
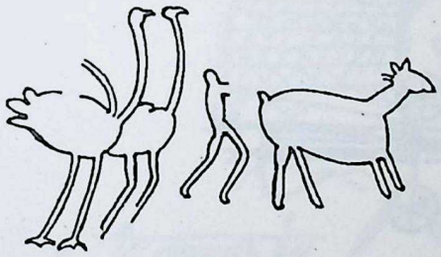


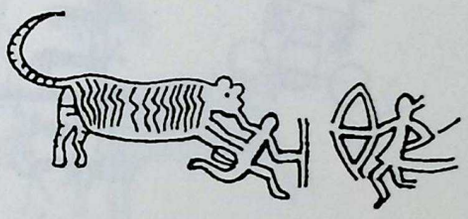
1. Narsimhagarh Kakshila



2. Kervaghat



3. Pachmarhi Bazargupha



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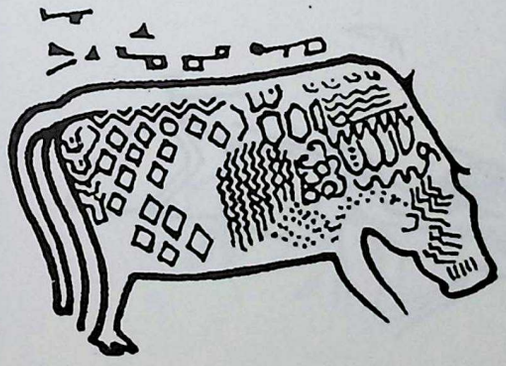
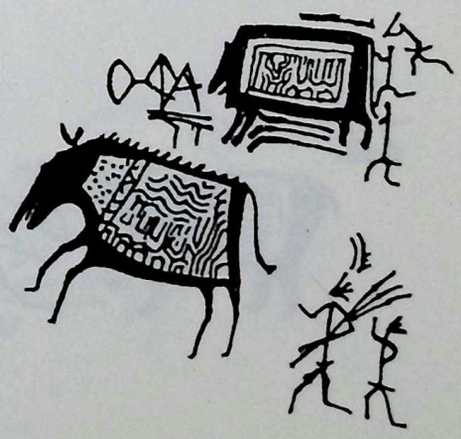


5. Phirangi



6. Phirangi

Plate 1

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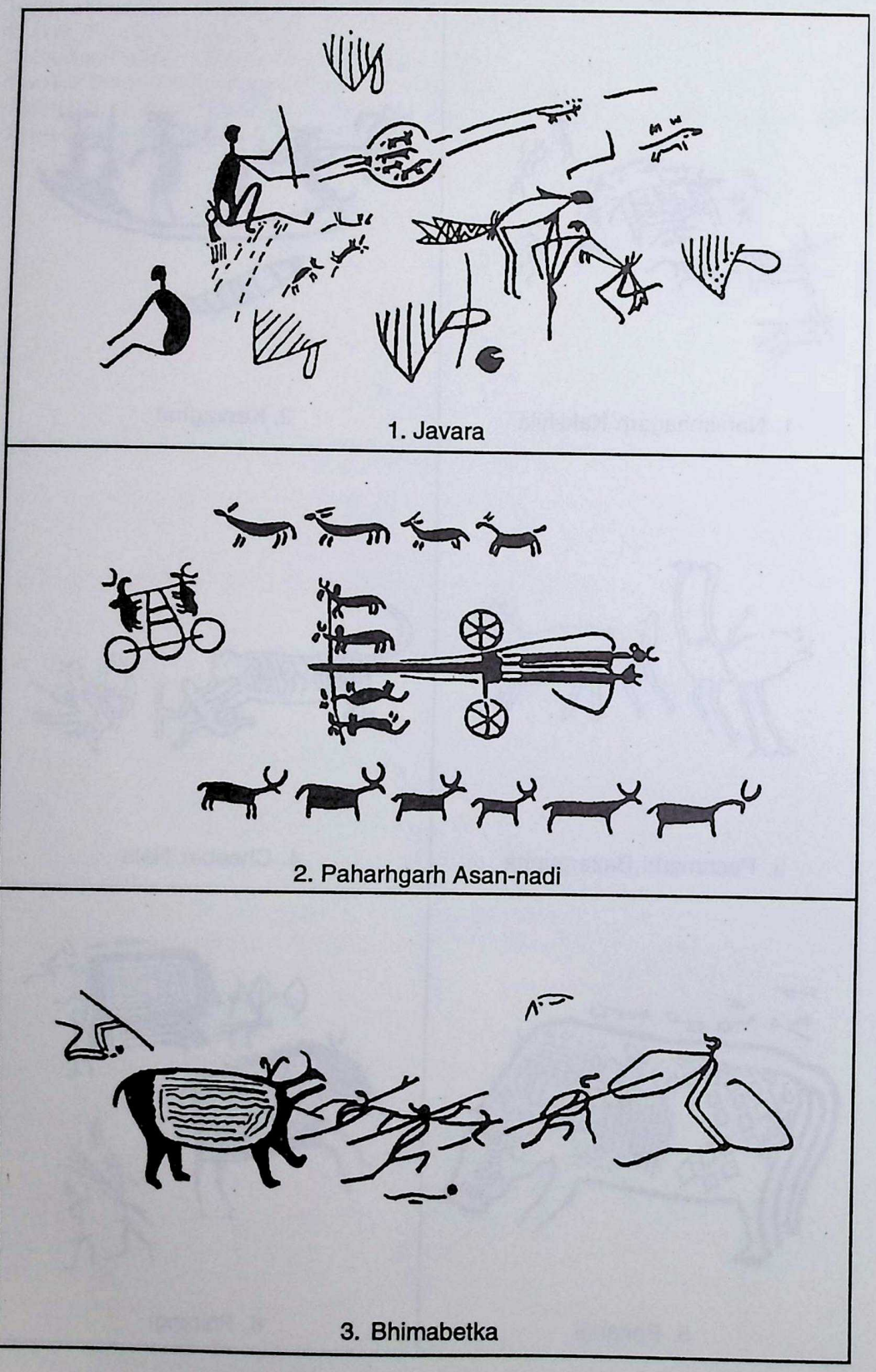

1. Javara

2. Paharhgarh Asan-nadi

3. Bhimabetka

Plate 2

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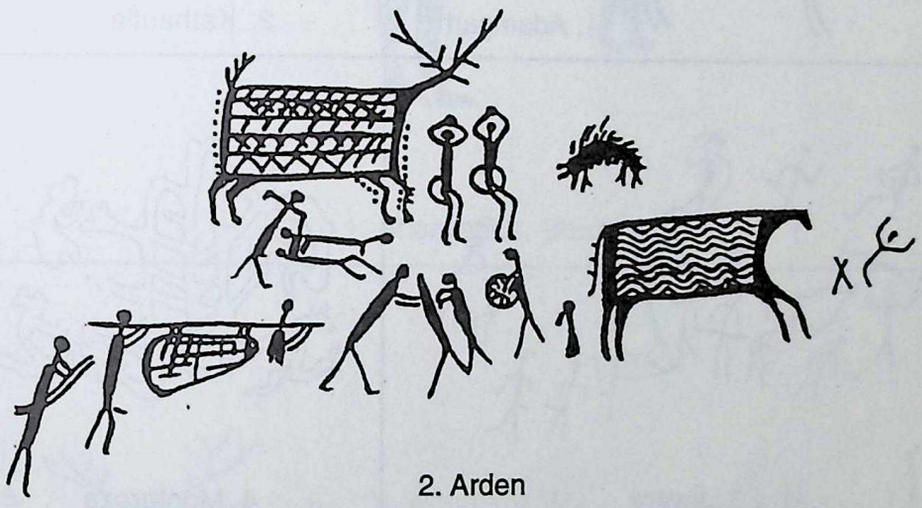
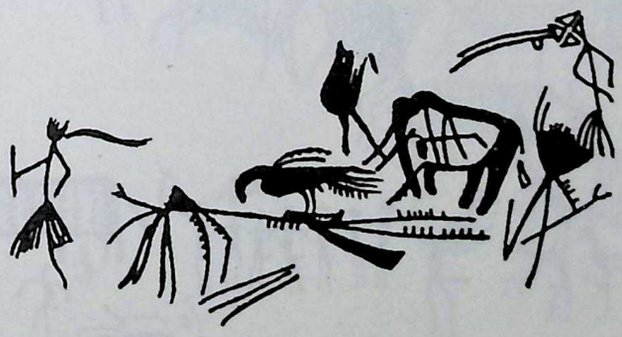
1. Lakhajwara



2. Arden



3. Guphamaser

Plate 3

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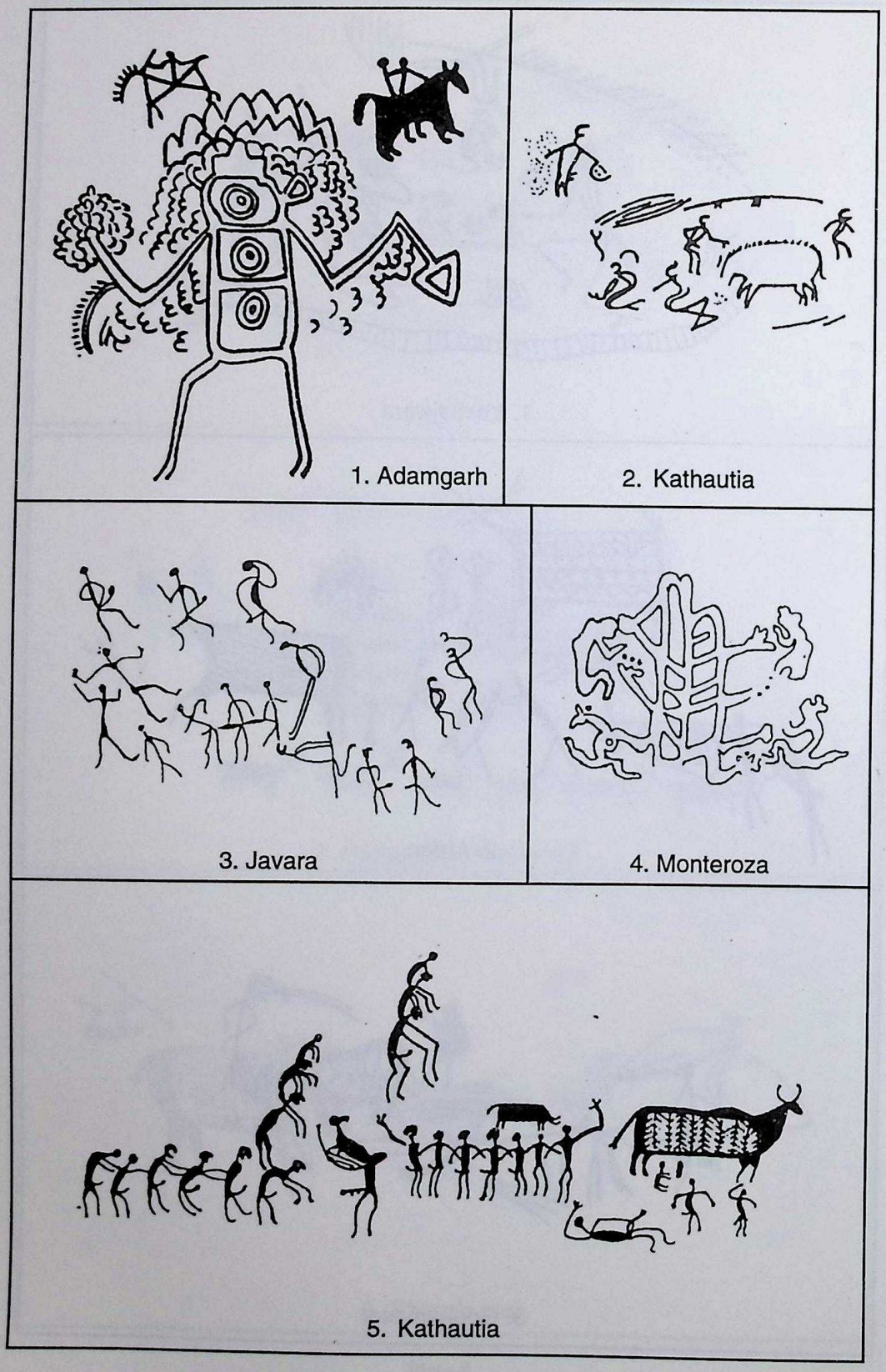

Plate 4

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1. Shamlahills, Bhopal

2. Shamlahills, Bhopal

Plate 5

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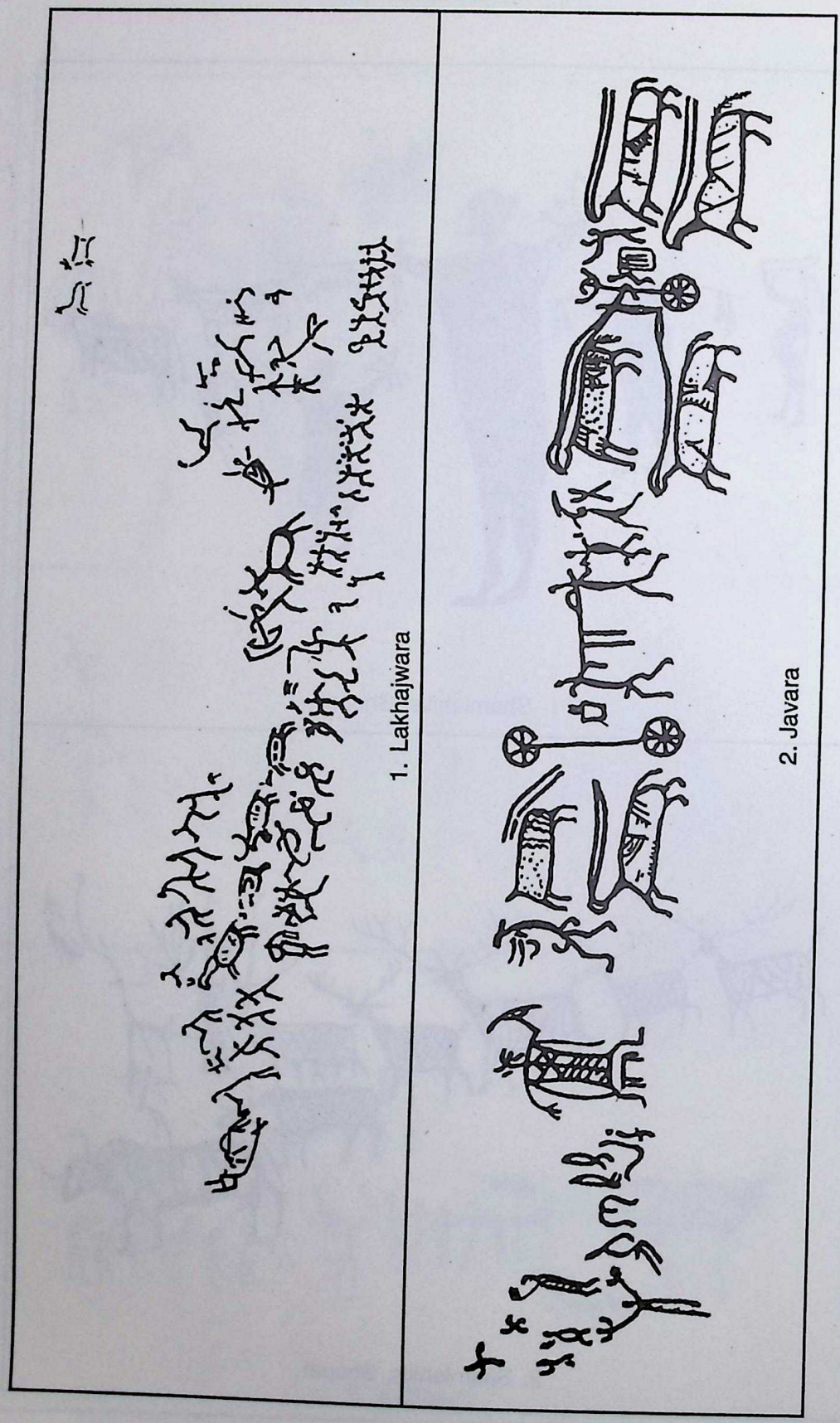

1. Lakhajwara

2. Javara

Plate 6

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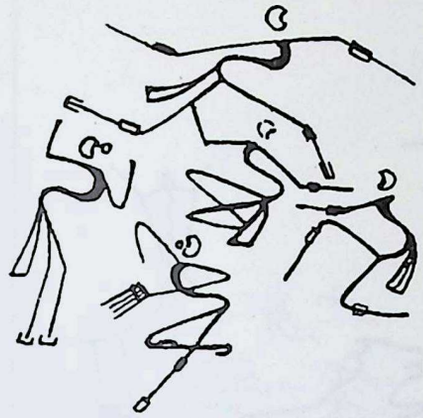
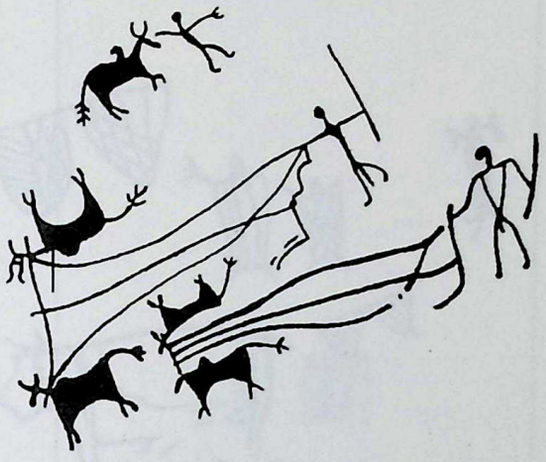
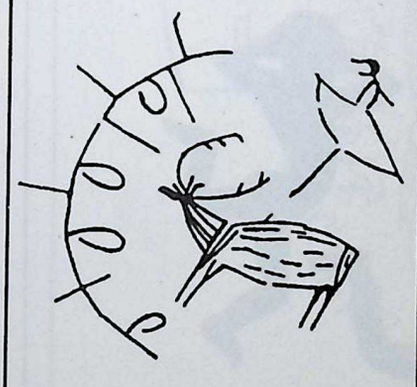


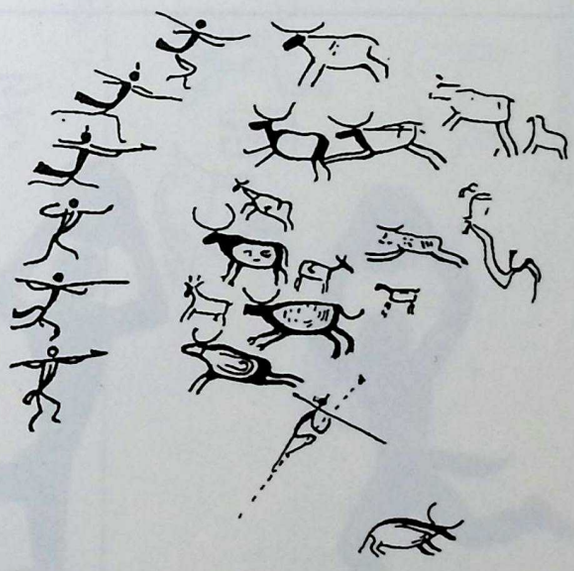
1. Lakhajwara



2. Chaturbhujnath Nala



3. Putlikrar



4. Arden

Plate 7

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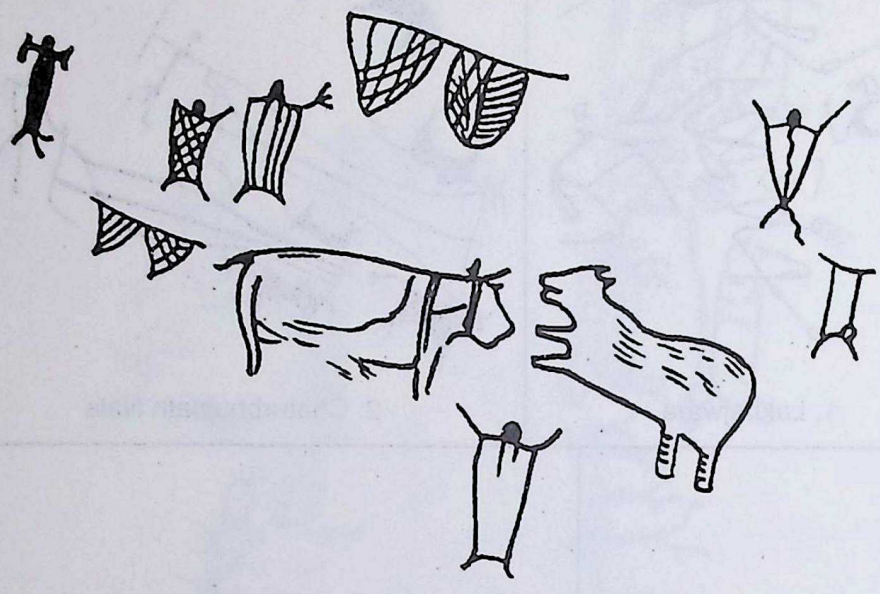
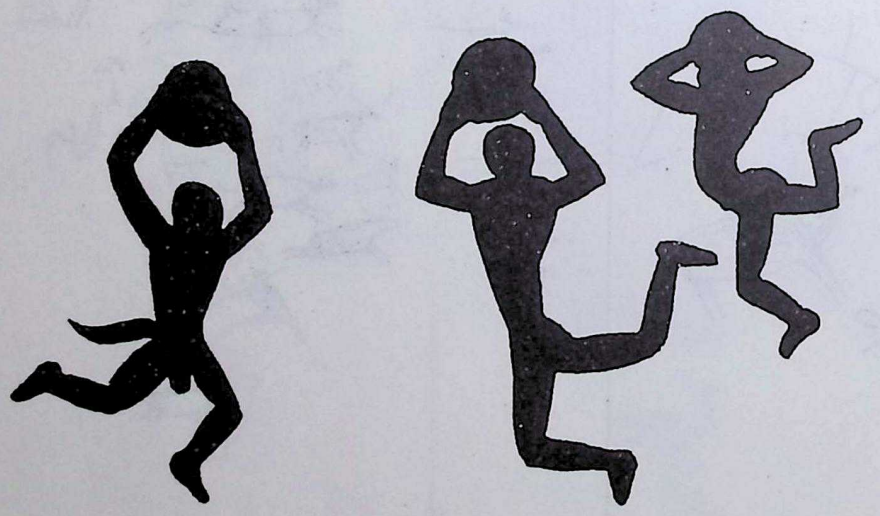


1. Raigarh-Singhanpur



Jambudweep—Pachmarhi

Plate 8

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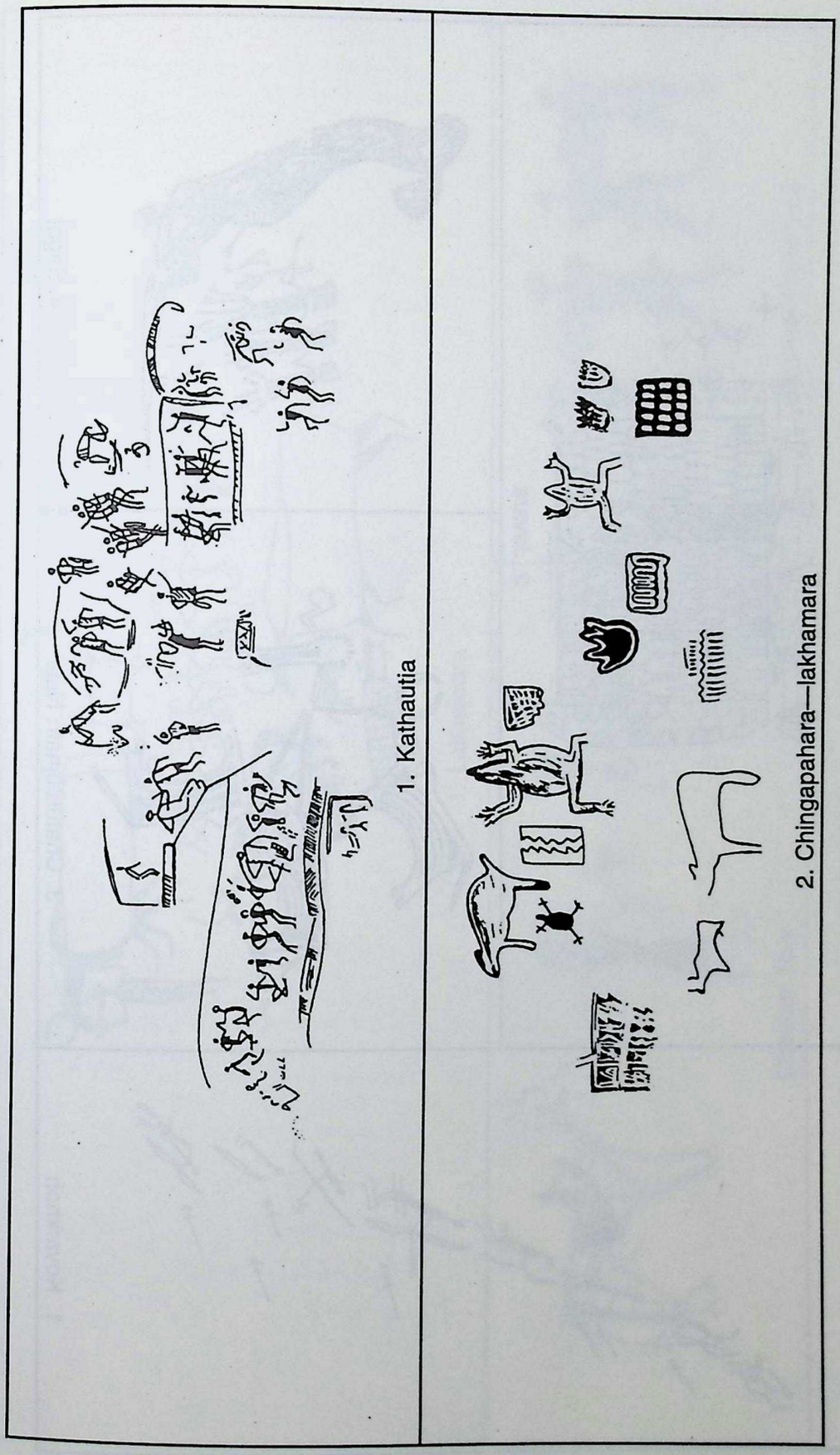

1. Kathautia

2. Chingapahara—lakhamara

Plate 9

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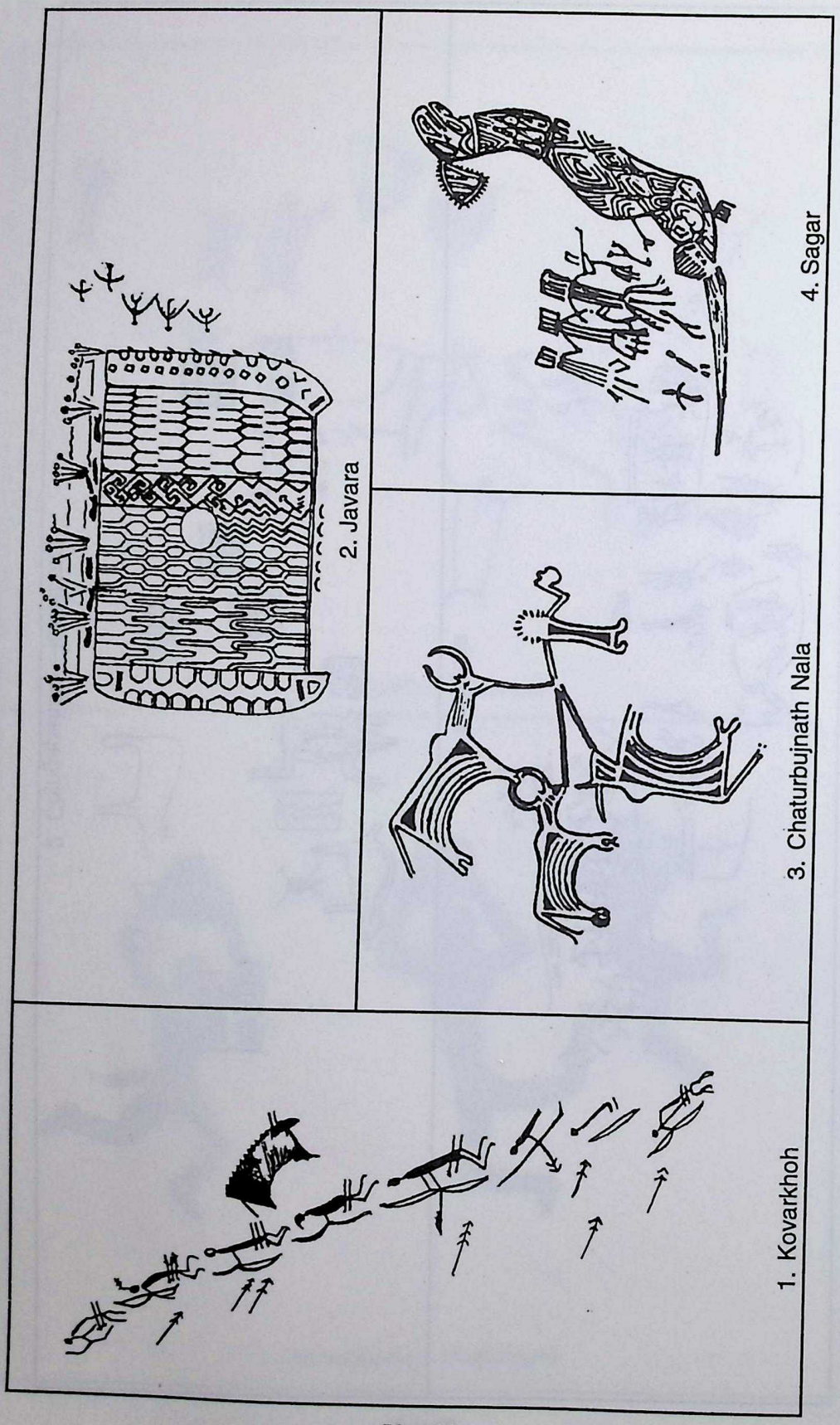

Plate 10

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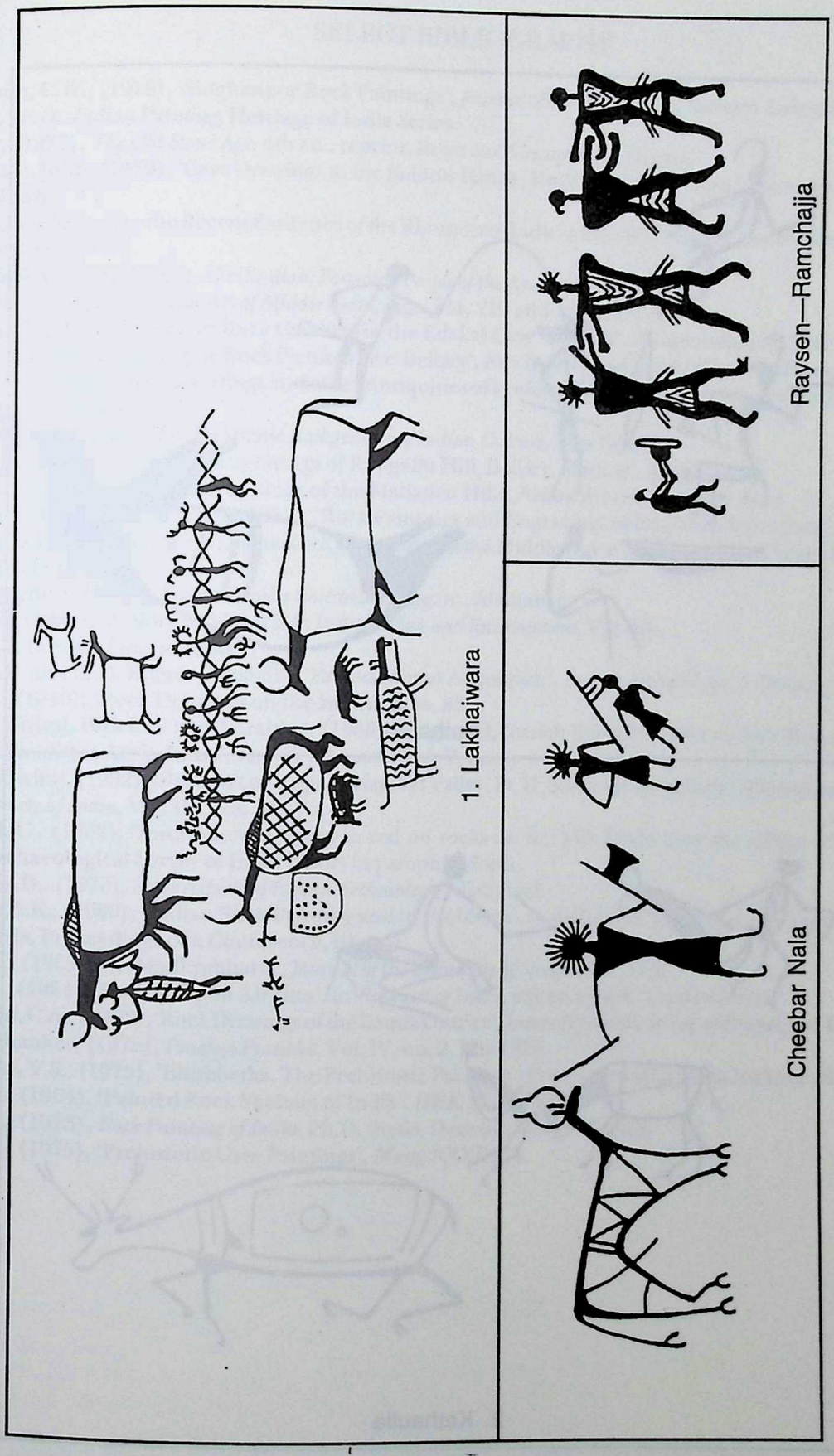

Plate 11

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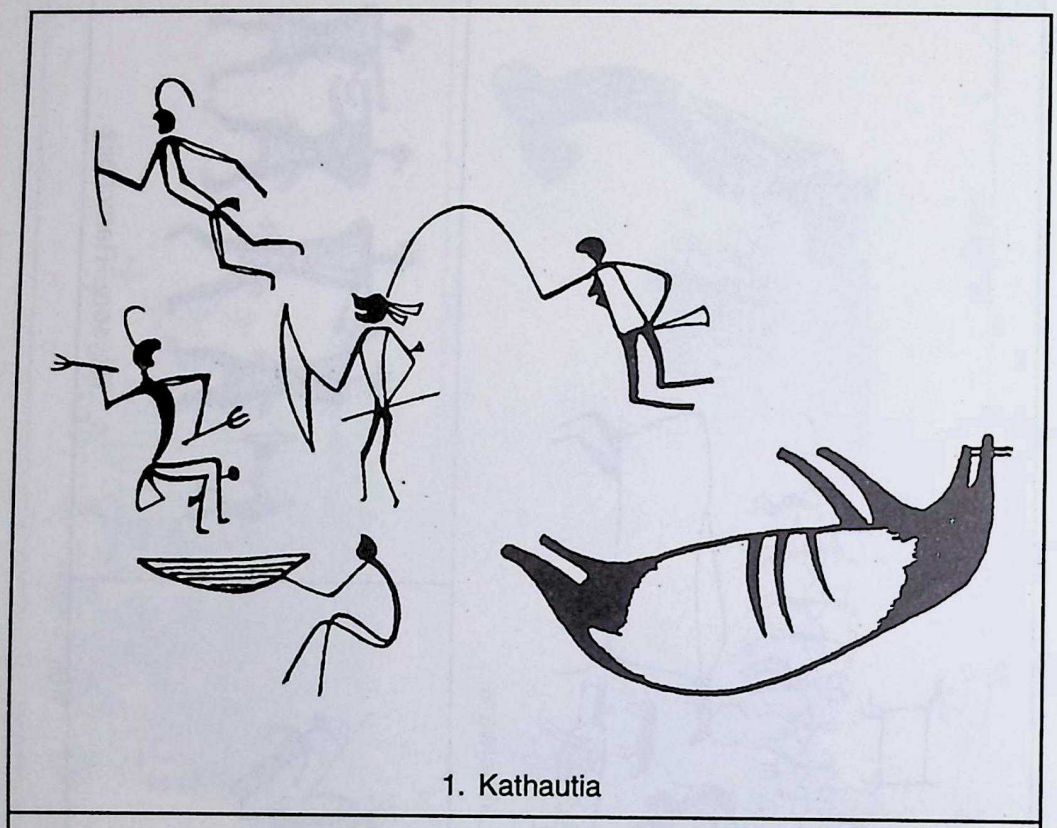
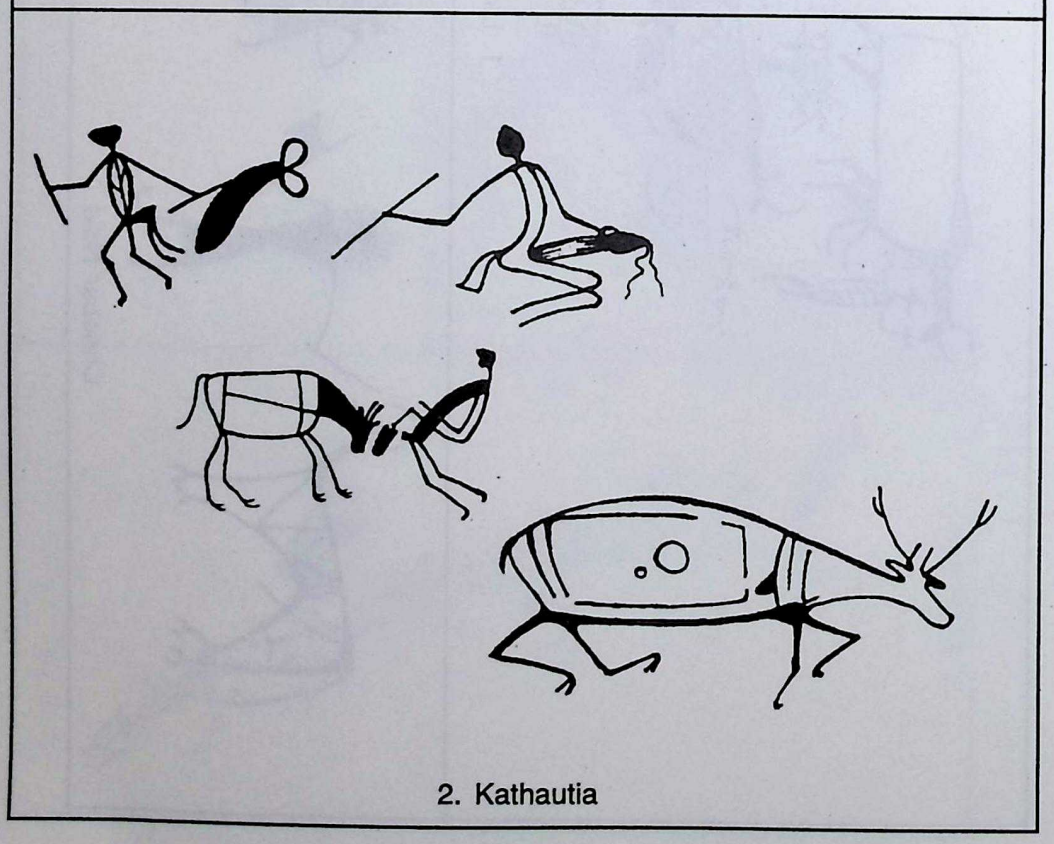


1. Kathautia



2. Kathautia

Plate 12

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CHAPTER X

Agriculture, Domestication of Animals and Ceramic and Other Industries in Prehistoric India: Mesolithic and Neolithic

V.D. Misra

The Mesolithic and Neolithic are the two Stone Age cultures datable to the Holocene. In the nineteenth century, when tools pertaining to these facies were picked up, their chronological horizon was not clearly understood. There was confusion regarding the chronological placing of the Mesolithic culture and the position of Neolithic culture was also not properly understood. Robert Bruce Foote, the father of Indian prehistory, postulated a theory of 'hiatus' between the Palaeolithic and Neolithic.[1] But archaeological investigations over the last five decades have cleared the chronological problems of these cultures. They have now been placed in proper archaeological context. The available evidence now clearly indicates that the Mesolithic culture in the Indian subcontinent, like its European counterpart, evolved out of the Upper Palaeolithic culture. The archaeological investigations carried out by the Department of Ancient History, Culture and Archaeology, University of Allahabad, in the Belan and Son valleys of the south-eastern Vindhyan area covering parts of Uttar Pradesh and Madhya Pradesh have placed these cultures in their geological sequence and chronological horizons. The available evidence clearly indicates a gradual evolution from Upper Palaeolithic to Mesolithic. It is also suggested that Neolithic culture evolved out of the Mesolithic. In this respect, the archaeological evidence from Chopani Mando, a Mesolithic site, and that from Koldihwa and Mahagara, Neolithic sites, are very significant.

In the following pages an attempt has been made to bring out the salient features of Mesolithic and Neolithic India, with special reference to agriculture, domestication of animals and ceramic and other industries.

I. MESOLITHIC

The Mesolithic Phase, as indicated earlier, constitutes a transitional stage from Palaeolithic to Neolithic. In the Indian subcontinent microliths, the characteristic tools of the Mesolithic, are reported from different parts of India. In this connection it may be pointed out that, barring major portions of the Indo-Gangetic plain and north-eastern India, microliths are found all over the country. It is another matter that in some areas such sites are heavily concentrated while in others they are not so prolific. The Vindhyan area abounds in

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Mesolithic sites. Recent archaeological investigations in the middle-Ganga valley, covering parts of the districts of Allahabad, Varanasi, Pratapgarh. Sultanpur and Jaunpur, have put this part also on the Mesolithic map of India. The Department of Ancient History, Culture and Archaeology, University of Allahabad, has been conducting explorations in the north-eastern Vindhyas, covering parts of Allahabad, Varanasi, Mirzapur and Banda districts in Uttar Pradesh and parts of Rewa, Satna and Sidhi districts in Madhya Pradesh and area of the middle-Ganga valley mentioned above over the last three decades, resulting in the discovery of more than 400 Mesolithic sites of which 207 are in the Vindhyas and 193 in the Ganga valley.[2] In the Vindhyas, microliths have been obtained either in open-air settlements or in rock shelters. However, the occurrence of microliths in the Ganga Valley has been noticed on the old banks of the Ganga, the Bhagar, preferably on or near horseshoe lakes. The wide distribution of Mesolithic sites both in the Vindhyas and the Ganga valley clearly indicates a wide operational area of Mesolithic hunter-gatherers, apparently a result of substantial growth in human population. It was during this period that man had started venturing out to enter a new area. In the Gangetic plains, the earliest evidence of man pertains to this period.

Mesolithic sites are located in thousands in different parts of the country, but the excavated sites are few and far between. Among the latter mention may be made of Birbhanpur[3] in West Bengal; the Teri sites[4] in Tamil Nadu; Nagarjunkonda[5] in Andhra Pradesh, Sangan Kallu[6] in Karnataka, Bhimbetka,[7] Baghor II,[8] Medhauli,[9] Banki,[10] and Ghagharia,[11] in Madhya Pradesh; Bagor[12] in Rajasthan; Langhnaj[13] in Gujarat; Lekhahia,[14] Baghaikhor,[15] Morahna[16] (Mirzapur), Chopani Mando[17] in Allahabad [Pl. I]; Bhadahwa[18] (Varanasi) in the hilly tract of Uttar Pradesh. Of the excavated sites of the Ganga valley, mention may be made of Sarai Nahar Rai,[19] Mahadaha[20] and Warikalan-Damdama.[21] Of the excavated sites, Baghaikhor, Morahana IV, Lekhahia I and II, Ghagharia and Bhimbetka are rock shelters. The others are open-air settlements. In the following pages an attempt has been made to bring out the salient features of the Mesolithic culture in the light of the excavated materials.

Excavations at Mesolithic sites have exposed cultural deposits often of more than a metre. At Morahana an occupation debris of 1.13 metres is recorded. At Lekhahia, Chopani Mando, Mahadaha and Warikalan Damdama the Mesolithic deposits measure 1.07 metres, 1.53 metres, 0.6 metre and 1.5 metres, respectively. These deposits suggest that the sites in question were in occupation constantly or intermittently for considerable lengths of time. Was this simply due to the strategic and favourable location of the sites or to the tendency of Mesolithic people to settle at some sites for considerable periods or both? But one thing is clear, that by the Mesolithic period semi-sedentary settlement, if not wholly sedentary settlement, had become an established phenomenon.

Evidence of stone-paved floors and wattle and daub have been obtained from Bagor. At Bhimbetka floors made of flat stone slabs, along with a wall measuring 6 m in length and one meter width of stone boulders, was found. Excavations at Chopani Mando, Bagor II in the Vindhyas and Sarai-nahar Rai and Warikalan-Dumdama in the Ganga valley have also furnished structural evidence. At Chopani Mando, as many as twenty hutments were exposed (Pl. II).[22] Of these, two belong to phase II A, five to II B and the rest to phase III. At Baghor II evidence of as many as three hutments was brought to light.[23] At Sarai Nahar Rai[24] post-holes enclosing a community hearth were exposed. The periphery of these hutments was marked by post-holes while on the floors were found scattered large numbers of sandstone fragments, microliths, animal-bone fragments and, burnt-clay lumps with reed impressions. At Warikalan-Damadama circular or semi-circular burnt-plaster floors were exposed.[25] Often these floors have multiple layers of burnt-plaster floors. These plastered floors might have been used for living areas as well as for roasting animal flesh as is evident from the presence of charred animal bones on such floors. That such floors were also used for workshops, i.e., manufac-

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turing areas, is evidenced by the microliths and bone objects found on them not only in good numbers but also in different stages of manufacture.

The microlithic assemblages of these sites include scrapers, points, borers, blades, blunted backs, lunates, and, occasionally, triangles and trapezes along with flakes, cores and debitage fashioned on quartz, chert, chalcedony, agate, carnelian, etc. For understanding the developmental sequence of microlithic industries, the results of the excavations conducted at Morahana and Lekhahia in Mirzapur, Chopani Mando in Allahabad, and Bhadahwan Pahar in Varanasi are very significant. The combined testimony of these excavations has established the following sequence of the microlithic industry:

Phase I: Non-geometric, pre-pottery, heavily patinated, (Pl. III).
Phase II: Geometric tools, triangle alone, without pottery.
Phase III: Geometric tools, triangle and trapeze with pottery. (Pl. IV).
Phase IV: Geometric and diminutive tools with hand-made pottery.

Excavations at Chopani Mando, Sarai Nahar Rai, Mahadaha and Warikalan-Damdama exposed pit-hearths. At Chopani Mando four circular hearths have been opened. At Sarai Nahar Rai eight small hearths and one community hearth, circular or oval in plan, were excavated. At Mahadaha the excavated hearths number eight. Of these one was circular and seven oval in shape. At Warikalan-Damdama as many as 32 hearths, circular or oblong in plan, were opened. These hearths at the sites were divisible into two groups: simple, shallow pit-hearths and hearths with clay plaster on side walls or bottom or both. The exposed hearths whether in the Vindhyas or Ganga valley are of the pit hearth type and exhibit only slight variations in diameter and depth. These contained charred and semi-charred animal bones, burnt clay lumps and blackish soil resembling ash. Only at Chopani Mando was charcoal also obtained from these hearths.

The available evidence from the hearths clearly indicate that Mesolithic folk used to roast meat before eating it. As these hearths have yielded only animal bones, it is also evident that cannibalism was not practiced in the Mesolithic society under discussion.

Excavations at Adamgarh, Langhnaj, Bagor, Sarai Nahar Rai, Mahadaha and Warikalan-Damdama have yielded a corpus of animal bones. Animal species identified so far include *Bos indicus, Bos bubalus,* including *Bos gaurus,* antelope, deer, *sus,* sheep, goat, *equus,* rhinoceros, etc. Bones of turtle, fish and birds were also found at the Mesolithic sites of the Ganga valley in appreciable number.

The occurrence of bones of animals, birds and aquatic creatures at the Mesolithic sites clearly indicates that these were killed by the Mesolithic people for their consumption. The faunal evidence from Langhnaj, Sarai Nahar Rai, Mahadaha and Warikalan-Damdama belong to the wild species while at Adamgarh and Bagor domestication of animals is indicated. At Adamgarh, dog, zebu, buffalo, goat sheep and pig are included in the category of domestic animals.[26] Of the Bagor assemblage, domestication has been suggested in the cases of sheep-goat and cattle.[27] This is the earliest evidence of domestication of animals in India and would suggest that the Mesolithic people at these sites were not only hunters but also practiced stock raising.

The Mesolithic sites, as indicated earlier, are characterized by microliths, raw material thereof and plenty of sandstone and quartzite fragments. In this connection, it may be pointed out that raw material for manufacturing microliths was brought often from distant places to the sites by Mesolithic man. Fragments of sandstone and quartzite are, however, locally available at some sites but at others these were also brought, often from a considerable distance away. In this respect, particular mention may be made of Baghor II, Medhauli and Banki in the Son valley and of Mahadaha and Wari Kalan, Damdama in the Ganga valley. The Son valley sites under discussion are situated on or near the Kudheri nullah, a tributary of the

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Son, at a distance of three to four kilometers, south of the Kaimur. The Kudhernullah flows through a limestone formation but the sites under discussion are littered with sandstone and quartzite fragments, the nearest source of which was the slope of Kaimur. In this connection it may also be mentioned that fragments of sandstone and quartzite are confined to the Mesolithic sites alone, suggesting thereby that these were brought to the sites by the Mesolithic people themselves. At the Mesolithic sites of Mahadaha and Wari Kalan-Damdama in the Ganga valley also sandstone and quartzite fragments are found in profusion. These could have been brought to the sites from the Vindhyan area. These Mesolithic sites have yielded fragments of querns (Pl. V), mullers (Pl. VI) hammer stones, anvils, (Pl. VII), anvil-cum-hammer stones, ring stones (Pl. VIII), and sharpeners fashioned on sandstone or quartzite. Of these, anvils and hammer stones could have been used in manufacturing microliths but the remaining items had to play a different role altogether. The occurrence of querns and mullers in plenty at these sites suggests that, in the life of the Mesolithic people, gathering had started playing a significant role. It is not unlikely that ring-stones obtained from these sites might have been used for digging out edible toots. The occurrence of these objects at Mesolithic sites is very significant. This suggests that these people used to collect wild cereals, edible roots, etc. for supplementing their dietary items. In this connection the finds of wild rice (*Oryza-Sativa*) from the late Mesolithic phase at Chopani Mando is of considerable importance (Pls. IX and X). The available evidence at the sites suggest that Mesolithic people had started collecting wild rice available in the area, suggesting thereby that in the economy of the Mesolithic people, vegetal food had become an essential element. In this way, gathering of vegetal food appears to play a significant role in the hunting economy of the people. It was a step forward towards cultivation of grains. In the Mesolithic period, as indicated earlier, in some areas man had started domesticating animals while in others he started collecting wild cereals like rice. Thus, by trial and error, he was on the threshold of the Neolithic revolution.

Pottery has been reported from a number of excavated sites pertaining to the Mesolithic phase. Of such sites, mention may be made of Langhnaj, Bagor, Nagarjunkonda,[28] Morahana Pahar, Baghaikhor, Lekhahia, Chopani Mando (Pl. XI), and Ghagharia rock shelter I. At most of the sites the sherds are very small and generally shapeless. The clay used for making the pots is not well levigated. It is coarse in fabric and composed of sand particles and minute lateritic pellets. At Nagarjunkonda only reddish-brown potsherds were found while at Langhnaj the ceramic assemblage was divisible into two groups, red ware and black-and-red ware. The red ware is further sub-divisible into burnished and coarse categories. At Chopani Mando the available pottery was divided into two groups on the basis of surface colour: ordinary red ware and brownish-red or khaki ware.

Even though limited in number, Mesolithic pottery exhibits the artistic taste of its makers. Incised or impressed designs are found on these pots. The former have been obtained from Langhnaj and Bagor, the latter from the Vindhyan sites. The impressed designs are also divisible into two groups: (*a*) pottery impressed by an engraved dabber, and (*b*) tortoise-bone impressed designs.

The impressed potsherds of Chopani Mando are represented by bowls and vases. The bowls are shallow or deep with featureless rim. The vases with straight or concave necks are small-sized. This pottery, thin-sectioned and ill-fired, represents the earliest attempt of man in this direction on the Indian subcontinent. A few sherds with such impressed design have also been found from Lekhahia rock-shelter I. Sherds of cord-impressed pottery, the diagnostic pottery of the Vindhyan Neolithic, have also been obtained from the rock-shelters of Baghaikhor, Lakhahia and Ghagharia, along with microliths. This indicates that the Mesolithic people at these sites were in touch with the Neolithic people of the Belan and Son valleys.

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Right from the time of the Neanderthal Man in the Middle Palaeolithic period, almost all the communities of the past have laid special emphasis on making elaborate arrangements for burials. There is no denying the fact that burials constitute one of the most thriving chapters in archaeology. If tools and weapons acquaint us with man's technical equipment, burials help us to glimpse into his beliefs and sentiments regarding life after death. In the case of preliterate societies, the significance of burials can hardly be overlooked as, in the absence of written records, these are the only means for reading the mind of the community to which the dead belonged.

Strangely enough, the earliest burials discovered so far in the Indian subcontinent pertain to the Mesolithic phase. The relevant information comes from Dorothy Deep[29] and Jambudvipa[30] and Bhimbetka rock-shelters in Madhya Pradesh, Langhnaj in Gujarat, Bagor in Rajasthan, Baghaikhor, Lekhahia RS I, Sarai Nahar Rai, Mahadaha and Warikalan-Damdama in Uttar Pradesh.

An examination of the burials exposed at these sites indicates that the Mesolithic people practised three modes of burials: Extended, Flexed and Fractional.

The practice of extended burials in shallow oblong graves was the most common one. The skeletons are generally found lying in a supine position. Extended burials are reported from Dorothy Deep, Jambudvipa, Baghaikhor and Lekhahia rock-shelters, Baghor I, Sarai Nahar Rai, Mahadaha and Warikalan-Damdama. One burial at Langhnaj also falls into this category. The graves have generally yielded skeletal remains of single individuals, male, female, adult or child, However, the Mesolithic sites of the Ganga valley have also exposed graves with double or even multiple burials. At Sarai Nahar Rai one grave yielded skeletal remains of four individuals, two males and two females, all buried simultaneously. The males were found placed on the right side and the females on the left. At Mahadaha double burials (Pl. XII) were encountered in two graves. In one grave one skeleton was found lying upon the other while in the other the two skeletons were lying side by side. At Warikalan-Damdama double burials were found in five graves while one grave yielded skeletal remains of three individuals. Of the double burials in four graves, the skeletal remains of one male and one female, the female lying on the left side, were obtained. In one grave, both the skeletons were those of males. The triple burials at the site yielded skeletal remains of two males and one female.

Skeletons of bodies buried in a flexed position have been found at Langhnaj and Lekhahia RS-1. At Langhnaj, with one exception, all the skeletons were found in flexed position. At Lekhahia only skeleton IV furnished this type of evidence.

Evidence of fractional burials has been obtained from Bhimbetka and Langhnaj. This mode of burial does not appear to have been popular during the Mesolithic period.

From some of the graves grave goods have also been obtained. Langhnaj reports microliths, animal bones and beads. At Lekhahia RS I, at least in two cases, viz. Skeletons II and V, evidence of burial goods has been encountered. With Skeletons II were found the left half of one animal mandible, two horns of a deer and a mollusc shell. Skeleton V was found associated with a buffalo rib. At Bhimbetka, a bone ornament and a pierced rib fragment of some animal were found in association of one of the burials. The occurrence of microliths in some of the graves of Sarai Nahar Rai does not necessarily make a case of burial goods as the microliths might have reached the graves unintentionally at the time of filling but the occurrence of animal bone fragments does indicate the placing of burial goods. At Mahadaha and Wari Kalan-Damdama, the available evidence on this point is very clear. From these sites, bone arrowheads, beads, pendants, etc. have been obtained from a number of graves, Mahadaha has yielded the skeletal remains of one individual wearing bone pendants and a necklace of bone heads.

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Osteological studies have furnished interesting data regarding the skeletons of Langhnaj on the one hand and Sarai Nahar Rai, Mahadaha and Wari Kalan-Damdama on the other, Dr S. Ehrhardt, after a careful study of the thirteen skeletons of Langhnaj, opined that the skeletons indicated traits characteristic of Mediterranids and Veddids, but which could include other races as well. The skeletons thus betrayed mixed features.[31] The skeletons exposed at the Mesolithic sites of the Ganga valley represented dolicocephalic people who were fairly tall with sturdy and had well-built physique.[32]

A rich crop of tools and weapons, fashioned out of stone and bone, has been collected from the Mesolithic sites. Among the food-processing equipments found mention may be made of querns and mullers made of quartzite and sandstone. Besides these, hammer stones, anvils and sharpeners, made on quartzite and sandstone, have also been obtained. The occurrence of bored stones or ring stones has also been reported from Langhnaj, Bhimbetka, Bagor, Chopani Mando, Baghor II, Banki and Medhauli. The Mesolithic sites of the Ganga valley have yielded bone arrowheads, both long and small (Pl. XIII). In this connection it may be pointed out that in the Vindhyas bone tools are rare in the Mesolithic context. However, in the Ganga valley the non-availability of raw material for manufacturing stone tools, particularly microliths, might have forced these people to search for unconventional raw materials. The bone tool industry was the outcome of the search.

Excavations and explorations at Mesolithic sites in different parts of the country have resulted in the recovery of thousands of microliths, the diagnostic tools of the period. This microlithic industry is characterized by cores, flakes, debitage and finished tools, fashioned on chert, chalcedony, agate, carnelian, quartz, etc. The microlithic assemblage comprised retouched, utilized, backed and truncated blades, points, *percoir*, scalene and isosceles triangles, trapeze, lunates, tranchet and scrapers. The industry often exhibits an excellent workmanship. For manufacturing tools, nodules of semi-precious stones were dressed. Blades/flakes were obtained from the resultant cores. At one or both the ends of the prismatic cores, striking platforms were prepared for detaching blades as blanks. These blanks were converted into different types of tools. For obtaining the blanks, the indirect percussion technique was resorted to. The working edges of microliths were retouched for making them sharper. The tools were retouched dorsally and ventrally or partially dorsally and partially ventrally. These microliths were composite tools. These could have been put to various uses as sickles, arrowheads, etc.

The available evidence indicates that the Mesolithic people had devised ways and means of decorating themselves. In India the earliest use of ornaments has been traced back to the Mesolithic phase. Ornaments like beads, ear-rings and necklaces made of bone beads have been obtained. Beads of semi-precious stones are reported from Adamgarh and Bhimbetka while Mahadaha and Warikalan-damdama have yielded beads and ear-rings made of bone. In this connection it may be pointed out that excavations at Mahadaha have yielded valuable information regarding the process of manufacture of bone. Antler bones were sliced and converted into bands (Pl. XIV). Some of the antler pieces bore incisions and deep grooves. One area of the site yielded not only a few complete beads but also beads in different stages of manufacture.

The hilly areas of Madhya Pradesh and Uttar Pradesh abound in natural rock-shelters. A majority of these rock-shelters bear painting on their walls or ceilings or both. The floors of these rock-shelters are often found littered with microliths, suggesting thereby that these were occupied by Mesolithic people. Some of these rock-shelters contain habitational deposits, indicative of their long occupation. As stated earlier, some of the rock-shelters have yielded human burials also.

Though, the paintings in the rock-shelters cover a long duration of time, the majority of them appear to have been executed by the Mesolithic people. On the basis of superimposi-

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tion, style and theme, the paintings of Mirzapur and adjoining areas are divided into four phases[33] while those of Bhimbetka group into nine phases[34] of which phases I-V are ascribed to the Mesolithic period.

The paintings, though primarily portraying animals, also depict man in dancing and hunting scenes. The animals are shown standing, moving, running, gazing etc. In the earlier series, only large-sized individual animals are depicted. In the subsequent phase, these are shown in groups. Stylized figures constitute the third phase. The paintings have been executed in red, white or black colours, the red being the most favoured. Objects are depicted both in outline and flat wash on the natural surface of the rock. The colours were obtained by grinding of minerals like hametite etc., ground nodules of which have been obtained in course of excavations. Plant juice and animal fat are likely to have been mixed with this paste. Dr Wakankar had opined that the earliest paintings executed in green colour may be ascribed to the Upper Palaeolithic period.[35]

For computing the chronology of the Mesolithic cultures of India, mention may be made of a series of C14 dates obtained from Baghor II,[36] Barkhera,[37] Adamgarh,[38] Bagor phase I,[39] Lekhahia RS I,[40] Langhnaj,[41] and Sarai Nahar Rai.[42] The combined testimony of these dates would suggest a range from the beginning of the Holocene to 2000 BC. In the closing phase the culture in the Vindhyas was in contact with the Neolithic culture as is evident from the occurrence of cord-impressed pottery, a diagnostic trait of the Neolithic of the area, in Baghaikhor, Lekhahia and Ghagharia rock-shelters.

II. NEOLITHIC

Before the excavation by Sir Mortimer Wheeler at Brahmagiri[43] our knowledge of Neolithic culture in the Indian subcontinent was very very limited. It was confined to different objects discovered as surface finds from various places. One was left in darkness about the nature and chronology of the first farming cultures of India. Against this background the archaeological evidence of Brahmagiri for the first time put the Neolithic culture of India in a proper stratigraphic sequence. The result of excavations not only added substantially to our then existing knowledge of the Neolithic culture of South India, it also opened a new horizon for future researches. If the Neolithic culture of South India could be put in its archaeological context, the Neolithic cultures of other parts of the country may also be put in their proper perspective if these were subjected to excavation.

The Neolithic phase, as per archaeological evidence, flourished in different parts of the country. Taking ecological and geographical factors into consideration, it is but natural that the cultures of different parts would exhibit their distinct personalities. Piecing together the information available up to 1960, Krishnaswami[44] divided the Indian Neolithic into four geographical regions:

A. Central and Western India
B. Southern India
C. Eastern India
D. Kashmir

Thapar[45] grouped them into three: Northern, Southern and Eastern. Allchin,[46] mainly on the basis of the distribution of Neolithic axes and their peculiarities was inclined to group the Neolithic cultures of India into five: (*i*) Northern, (*ii*) Southern, (*iii*) Eastern (*iv*) Central and (*v*) Eastern-Central. In view of some new finds and taking into consideration the whole of Indian sub-continent, Thapar[47] regrouped the Neolithic cultures into six geographical regions: (*i*) North-Western, (*ii*) Northern, (*iii*) North-Eastern, (*iv*) Central-Eastern, (*v*) Mid-

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Eastern, and (*vi*) Southern. In recent years, however, a new Neolithic zone covering the Vindhyan plateau[48] in districts Allahabad, Mirzapur (UP), Rewa and Sidhi districts (Madhya Pradesh) has also been brought to light. The available archaeological material clearly demonstrates the distinct personality of the Vindhyan Neolithic culture.

In the following pages an attempt has been made to bring out, with special reference to agriculture, domestication of animals, ceramic and other industries in prehistoric India, the salient features of the Neolithic cultures of (*i*) North-Western India, (*ii*) Northern India, (*iii*), the Vindhyan region, (*iv*) the Mid-Ganga Valley, covering eastern Uttar Pradesh and Western, Southern and Northern Bihar, (*v*) South-eastern India covering parts of Bihar and Orissa, (*vi*) North-Eastern India covering Assam and the sub-Himalayan region, and (*vii*) Southern India covering peninsular India.

Neolithic of the North-Western region:

Archaeological evidence during investigations over the last five decades in parts of Baluchistan, the North-west Frontier Province and Punjab of Pakistan, relics of Neolithic cultures have been obtained. The relevant sites include Kile-Gul-Mohammad,[49] Rana Ghundai,[50] Surjangal,[51] Anjira I,[52] Siah-Dam,[53] Mehargarh,[54] Gumla,[55] Leuran,[56] Tarakai Qila,[57] Rahman Dheri,[58] Sarai Khola,[59] Jalilpur,[60] etc. The combined testimony of these sites has brought into focus three phases of the Neolithic culture in the area under discussion. The first phase is aceramic, in which potsherds have not been found. It is represented at Kile Gul-Mohammad, Mehargarh and Gumla. Mehargarh is the representative site of the phase. The second phase, characterized by hand-made pottery, is represented at Kile Gul-Mohammad Pd. II, Rana Ghundai Pd. I, Surjangal, Mehargarh II A, Sarai Khola I and Jalilpur I. The third phase, associated with wheel-thrown pottery, is recognized at Anjira and Mehargarh II B and III.

The aceramic phase has yielded evidence of mud or mud-brick structures, ovens, graves (Mehargarh), etc. The graves containing bodies in contracted positions have also yielded burial goods in the form of a copper bead, turquoise beads and baskets with bitumen coating. Of other objects obtained from this phase mention may be made of points and awls of bone, stone blade industry items including trapeze, lunate, triangle, etc., ground stone axe, hammer stones, querns and grinding stones.

This phase of Mehargarh has yielded evidence of the earliest agriculture and domestication. The Neolithic people used to cultivate wheat and barley. They also ate dates. Among their domesticated animals, mention may be made of cattle and water buffalo. Bones of wild sheep, goat and some other animals were also obtained. The available evidence indicates a marked increase in the bones of cattle and a decrease in the bones of sheep and goat.

Phase II at Mehargarh is the continuation of the earlier phase, viz., Phase I. Handmade coarse potsherds were obtained from the horizon of II A while from the horizon of II B both handmade and wheel-thrown pots were found. Some potsherds bearing basket impressions were also obtained. The pottery with basket impressions and some pointed decorations of this phase are comparable with their counterparts obtained from Mundigae I and Kilg-ul Mohammed II. The latter site has also yielded some rusticated sherds. Handmade burnished potsherds with mat impressions have also been found at Sarai Khola, Leuran and Gumla. Besides this Sarai Khola has yielded evidence of rusticated pottery also. The handmade pottery, of Jalilpur, made from bright red clay, has a soft crumbling surface, resembling the ochre-coloured pottery of later times. Rusticated pottery has also been obtained from this site.

Of the other objects found from this phase, with special reference to Mehargarh, mention may be made of stone blade industry artefacts, fragments of conch-shell, objects of turquoise, a perforated pendant of lead (the earliest of its kind in Indian subcontinent), beads of lapis lazuli, and a small terracotta figure of a male. The occurrence of objects fashioned on

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conch-shell, turquoise and lapis lazuli obtainable only from distant places like the Arabian Sea coast, Turkmenia and Badakshan, suggests the prevalence of trade even though it might have been at a rudimentary level.

Data pertaining to cultivation and domestication, are profuse. Wheat and barley were the popular cereals. Evidence regarding the cultivation of cotton, the earliest evidence of its kind, has also been obtained from Mehargarh. In this phase, a granary was also constructed at Mehargarh. Besides the bones of sheep, goat and cattle, Ranaghundai Pd. I had also yielded bone of ass and four equine teeth according to Ross. However, Zeuner was inclined to ascribe these teeth to *equus onager* rather than to horse.

From this phase two flexed burials have also been reported. The graves did not yield any burial goods unlike the graves of phase I. However, a covering of red ochre on the body was discernible.

Of the Neolithic sits of this phase, Sarai-Khola has furnished interesting evidence of pit-dwelling. In this connection it may be recalled that pit-dwelling was a diagnostic trait of the early Neolithic culture of Kashmir Valley.

With the third phase at Mehargarh is associated wheel-thrown painted pottery. The painted motifs at this site compare well with their counterparts of Kile-Gul-Mohammad II and III on the one hand and with those of Mundigk and Trogau Ware on the other. Beads of lapis lazuil, turquoise and other semiprecious stones were also obtained. Fragments of conchshell are also recorded. The available evidence suggests long distance trade. Use of pottery in everyday life is also indicated. Diversification in agriculture is also hinted at. At Lewan in the Bannu Basin a factory site manufacturing specialized stone tools, including ringstone, ground axes, hammer stone, and querns, has been reported. These objects have been fashioned on locally available raw materials. Blades made on semiprecious stones are prolific at the site. Painted pottery at the site shows many traits common with its counterpart at Rahman Dheri Pd. I. Among the painted motifs mention may be made of fish and pipal leaf. This phase at Rahman Dheri has yielded not only ordinary mud-brick structures but a mud-brick defence wall as well. The available evidence suggests that, gradually, the culture was moving towards incipient urbanization, ultimately resulting in the urbanization of the Harappa culture.

The combined testimony of C14 dates available from Kile Gul Mohammad,[61] Mehargarh,[62] Rahman Dheri[63] and Ranaghundai I[64] would suggest a date bracket from the seventh millennium BC to the middle of the fourth millennium BC for the Neolithic culture of north-west India.

As far as the origin of the Neolithic phase in north-west India is concerned, the available evidence, whether looked from the angle of agriculture or domestication or the microlithic component, demonstrated that the culture had a local origin and its authors were local geniuses rather than colonizers coming from outside, The ancestors of the domesticated plants were available in the area in wild form. The same statement holds good about domestication of animals as well. Of special significance is the domestication of buffalo. As this species was not available in Western Asia the question of its introduction from that direction is clearly ruled out.

Neolithic Culture of Northern India (Kashmir Valley)

The Neolithic culture in the Kashmir Valley with its characteristic traits is represented by nearly three dozen sites.[65] All these sites are located on the elevated Karewas, overlooking rivers and lakes of these two sites, Burzahom[66] and Gufkral[67] have been excavated. Both sites have yielded evidence of three distinct cultures – Neolithic, Megalithic and historical. However, the excavations at Gufkral have furnished evidence of an aceramic phase, while at Burzahom this phase was not detected. At Burzahom, the Neolithic phase was divided into two

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phases, I and II, while at Gufkral it is divided into three sub-phases, IA, IB, and IC. In the light of the Gufkral evidence, sub-phase I of Burzahom should be bracketed with IB of Gufkral while the II of the former should be bracketed with sub-phase I C of the latter.

During the aceramic phase I A, the subsistence economy of the Neolithic people appears to have been based on farming, stock-raising and hunting. Bones of ibex, bear, sheep, goat, cattle, wolf and Kashmir stag have been obtained. Of these, sheep and goat were domesticated; wheat, barley and lentils were cultivated. People lived in underground pits, circular or rectangular in plan. Oval or squarish pits were also occasionally met with. The natural loessic soil, locally known as *karewa*, was cut into for obtaining these pits. The floors of these pits were often painted in red ochre. Along the periphery of the mouths of these pits the presence of post-holes was noticed, suggesting that the pits used to be covered overhead. This was necessary for protecting the inhabitants from rain and winter storms. The non-occurrence of hearths inside the pits indicates that they were used only for living in. Evidence of plastered floors, hearths and shallower pits was also recorded in the close proximity of these pits. Of these, the shallower pits with floors painted in red ochre were probably used as storage bins.

The Neolithic people of Kashmir during the aceramic phase used tools and weapons fashioned on bone and stone. As these are found in various stages of manufacture, their local production is self-evident. Of the bone tools found from the sites mention may be made of points, needles, harpoons and scrapers. The stone tool assemblage made on Himalayan trap comprised axes, drills, picks, points, pestles, ponders, querns and ringstones (maceheads?). The available evidence suggests that the bone tools were prepared out of the bone of goat, sheep and stag.

In sub-period IB also people used to live in artificial subterranean pits. Thick floors composed of clay mixed with chunam, storage pits and hearths were also recorded. This sub-period also saw the introduction of handmade pottery. The ceramic assemblage comprised three principal fabrics – thick coarse grey ware, fine grey ware, and gritty dull red ware, the first one being predominant. The main pottery types included globular jars, bowls and basins. Bowls and basins are characterized by ring or disc bases, often with a mat impression. The other decorative motifs included pinched designs in the neck and reed impressions.

Animal remains represented sheep, goat, cattle, wolf, dog, red deer, ibex and bear. Of these sheep, goat and cattle were domesticated. However, the presence of wild sheep, goat and cattle is also indicated. A short-horned variety of cattle is also met with. These, along with red deer, ibex and deer, were hunted. The available evidence suggests that hunting still played an important role in their life and through it the Neolithic people augmented their food supply. Bones of domesticated fowls have also been obtained, indicating its use in their menu. Presence of bones of dogs in appreciable number suggests that this animal was also domesticated during this period. Besides domesticating of animals, the people also cultivated wheat, barley, lentils and the common pea. In this connection, it may be pointed our that the common pea was a new item which appear to have been introduced during this period.

From this period also a sizable number of bone and stone tools have been obtained. The bone tools repertoire included harpoons, needles (with or without eyes), awls, spears, points, fashioned on antler horns. The main stone tool comprised axes, chisels, adzes, pounders, maceheads (ring stones?), points and picks. A stone quern was also obtained.

The last phase of the Neolithic culture of Kashmir, IC (Pd. II of Khazanchi), exhibits both continuity and change. Underground pit and chamber dwelling was abandoned; over ground dwelling units made of mud or brick or both are unearthed. Besides sheep, goat and cattle, bones of pig and fish have also been found. Domestication of pig during this phase adds a new element in the Neolithic economy of Kashmir Valley. Bones of horse, hedgehog, rodents, and beaver have also been obtained.

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Among the cultivated grains pertaining to this period mention may be made of wheat, barley, lentils and common pea as in period IB.

Stone objects, though less prolific in comparison with the preceding period, include celts, points, querns, pounders, balls, double-holed harvesters, spindle-whorls and stone engravers. One of the double-holed harvesters was marked with incised decoration on one side. The stone engraver, according to Sharma, was used by potters for removing extra clay while finally shaping a pot.

Bone tools, as in the other two phases, were still much in demand. These are, however, better finished than their counterparts of the earlier periods. Of the important tools, mention may be made of points, arrowheads, awls, spatulas and harpoons. A bone object with four incised groves was also obtained.

Other finds of this period included terracotta bangles, cowry shells and a comma-shaped pendant of light-green jade.

The ceramic assemblage of the period comprised grey ware, burnished grey ware, rough and thick dull red ware, along with the introduction of black burnished ware and wheel-thrown black burnished ware. A few examples of red gritty ware were also obtained. Besides the pottery types of the earlier period, long-necked jars and dishes-on-stand with triangular perforated designs on the stem region were the new types available in this period. The potters of the period thus exhibited their aesthetic sense on their pottery. Decoration comprised mat and cord-impressed bases, reed impressions to create the roughened surfaces of grey and dull-red wares, pinched designs and incised oblique designs on the neck region of the wheel-made black burnished ware. From this phase of Gufkral, a sherd bearing graffiti was also obtained. From the corresponding phase of Burzahom a few painted pots, probably imported, were also found. By the end of the Neolithic phase at Burzahom, a wheel-thrown red ware pot containing 950 beads fashioned out of agate and carnelian, with excellent workmanship, was obtained. Another wheel-thrown red ware painted pot was found depicted with a horned figure. This pot might have been an import from the Kot-Diji phase of Sarai Khola. The beads of agate and carnelian are also out of context with the Neolithic phase. The occurrence of a few copper arrowheads, a ring, bangles and a pin in this phase are also intrusive as these do not fit-in in the Neolithic context in the Kashmir Valley.

This phase has furnished evidence for getting in touch with the artistic activity of the people. From Burzahom have been obtained two broken stone pieces with engravings.[68] One piece depicts a hunting scene in which a stag with antlers is being attacked both from the rear and front. The hunter from the rear is attacking the animal with a long spear while his counterpart in the front is attacking with an arrow. The upper portion of the slab depicts two circles with emanating rays and a dog-like animal. The circle may represent the sun. The engraving on the other slab, though incomplete, depicts a hut and the hind portion of an animal. It is interesting to note that both the pieces were obtained from one and the same structure.

Excavations at Burzahom have furnished interesting data regarding the burial practices prevalent in this phase. These burials were found mostly within the settlement. Grave pits, oval in outline, were dug out either in the house floors or compounds. The sides of the graves were found plastered with lime. Both primary and secondary burials were practiced, the former containing the skeletal remains in articulated position while in the latter only selected bones were buried. The primary burials at the site fall under the category of flexed burials in which the dead were placed in a crouched position. Red ochre has been found sprinkled over the human bones. Grave furniture does not appear a prevalent practice. However, some of the graves have skeletal remains of animals either complete or partially. The animal burials either whole or in parts include dog, wolf and ibex. From one grave were obtained the skeletal remains of five dogs and an antler's horn. The available evidence suggests the sacrifice of pets,

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particularly dogs and their placing in the grave alongside the master or owner. A human skull with seven finished and four unfinished circular holes furnishes evidence of trepanning.

For computing the chronology of the Neolithic culture of Kashmir, a few C14 dates obtained from Burzhom and Gufkral are helpful. According to Possehl and Rissman,[69] the aceramic phase may be placed within the time-bracket of 2800 BC to 2520 BC and the IB phase of Gufkral and period I of Burzhom within the time bracket of 2520-2000 BC. The final phase of the Kashmir Neolithic, i.e., IC of Gufkral and period II of Burzahom, are assigned to the 2000-1500 BC bracket.

Vindhyan Neolithic

Identification of a Neolithic culture in the northern Vindhyan area with a distinct personality is a new discovery in Indian archaeology. The persistent and planned archaeological investigations carried out in the Vindhyan area over decades by the Department of Ancient History, Culture and Archaeology, University of Allahabad, have resulted in the discovery of a number of Neolithic village settlements. The explored area ranges between 24° and 26° 30′ north parallel and the 80° and 84° east meridian. It is roughly bounded in the north by the Ganga and in the south by the Son. These sites are situated in the northern Vindhyan zone of Uttar Pradesh and the Madhya Pradesh plateau region, These Neolithic sites are found located in the Valleys of Belan, Adwa and Son. Of the important sites, mention may be made of Koldihwa,[70] Mahagara,[71] Panchoha,[72] Kukurahata,[73] Deoghat,[74] Koilariha,[75] Futaha,[76] Chauridih-Kotia,[77] Bansaghat,[78] Daiya[79] and Patehari[80] in the Belan Valley in Allahabad (UP); Magha,[81] Indari,[82] Baraunha,[83] Sinduria[84] and Mahalpur[85] in the Adwa Valley in Mirzapur (UP) and Kunjhun,[86] Lalnahia[87] and Dhodauhi[88] in Sidhi district of Madhya Pradesh. Of these, Koldihwa, Mahagara, Panchoha, Indari and Kunjhun have been excavated. These excavations have placed the Neolithic culture of the Northern Vindhyan region in a proper archaeological context. It is characterized by sedentary settlement, cultivation of rice, domestication of cattle, sheep, goat, etc., a rounded variety of polished stone axes, microlithic components, handmade pottery, etc.

The occurrence of burnt clay lumps with reed or split bamboo impressions (Pl. XV) at all the excavated sites indicated that the Neolithic people here used to live in wattle and daub hutments. However, the excavations at Mahagara, conducted on a bigger scale, exposed as many as 18 hutments. All these are circular or oval on plan. These were found littered with potsherds, animal bones, fragments of querns, mullers, hammer stones, microliths, stone celts, etc. On the periphery of the floors post-holes were detected. For protecting the inhabitants of the huts from winds, animals etc. these were provided with screen walls made of bamboo, reed, straw, grass, etc. These walls used to be plastered on both sides. In this connection it may be pointed out that this tradition is still prevalent in the Vindhyas. The exposed huts are found in clusters of three or two. The available evidence suggests that of the three huts in a unit, one was perhaps used for living purposes while the other two were meant for other activities such as tool manufacture, food-processing, cooking, etc.

A cattle-pen measuring 12.5 × 7.5 m surrounded by eight floors (four house units) was also exposed at Mahagara. The pen, irregular, rectangular on plan was enclosed by 28 post-holes with three openings. Absence of any post-hole inside the cattle pen indicates that it would have been open to the sky. Hoof prints of cattle of different age groups were detected in the pen.

The ceramic assemblage, obtained from the Neolithic sites is divisible into four distinct groups: cord-impressed, rusticated, burnished red, and burnished black. All the wares are handmade and ill-fired. The pottery types being simple are mainly represented by deep or shallow bowls and globular jars, Of the other available types, mention may be made of spouted bowls, basins and *handis*. The decoration on the pots is confined to cord-impressed designs

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(Pl. XVI) criss-cross and appliqué bands with incisions. No pot with painting has yet been found.

The Neolithic assemblage fashioned on basalt, granite and quartzite consists of celts, adzes and chisels, the first being predominant. These neoliths, polished all over the body, are small and are of rounded variety with rectangular or ovaloid cross-section. The absence of debitage at the sites on the one hand and the occurrence of neoliths in finished forms on the other strongly suggest that they were probably manufactured at the site of the raw material. No triangular celt, a characteristic trait of the South Indian Neolithic culture, has been found from any of the excavated sites.

Microlithic tools have been obtained from all the excavated sites. These are represented by finished tools, blades, flakes, cores and debitage, making a case for local manufacture. These are fashioned on crypto-crystalline silica comprising chalcedony, chert, agate, carnelian, quartz and crystal, the chalcedony being the most favoured raw material. Blades removed from small prismatic cores by punch technique, have been used for making different tools. Some of the tools are made on flakes as well. Of the finished tools available, mention may be made of parallel-sided, blunted, serrated and penknife blades, points, borers, scrapers, blades and flakes with use marks, triangles, trapeze, lunates and pellet-tranchet. These tools exhibit excellent workmanship.

Of the other stone tools, mainly the heavy-duty tools, obtained from these sites, mention may be made of querns, mullers, rubbers, hammer stones, tool-sharpeners and miscellaneous objects like balls, bored stones and discs fashioned on sandstone or quartzite.

Four single-tanged bone arrowheads, earthen discs with central perforation generally made of broken pottery, spherical clay beads, mostly sun-dried or ill-fired, and perforated shell pendant with ground sides are some other objects obtained from Mahagara.

The combined testimony of the excavated sites, particularly of Koldihwa and Mahagara, furnishes ample evidence regarding cultivation and domestication. Remains of rice, jujube and bamboo have been obtained. Evidence of rice is found in two forms as carbonized grains, and in the form of husk, the latter used in pottery as degraissant. On examination, the rice-remains have been ascribed to the cultivated variety, *Oryza sativa*, by Vishnu Mittre[89] and Chang.[90]

Of the animal bones obtained from Koldihwa and Mahagara, mention may be made of the bones of cattle, sheep, goat, horse, deer and bear. Bones of tortoise, fish and birds have also been found. Of these, cattle, sheep, goat and horse were domesticated.

From the above it would be evident that the Neolithic people of the Northern Vindhyas subsisted on farming, stock-raising and selective hunting. Besides the recovery of the cultivated variety of rice, *oryza sativa*, the occurrence of querns, mullers and storage jars in most of the houses is indicative of the prevalence of agriculture during the period.

The chronology of the Vindhyan Neolithic culture is in a melting pot. C14 dates have been obtained from Koldihwa, Mahagara and Kunjhun River Face. A few thermo-luminescence dates from Mahagara have been reported. The combined testimony of these dates, when calibrated, gives a time range from 3530-3335 to 1565-1265 BC.[91]

The roots of the Neolithic Culture of Northern Vindhyas may be traced back to the Mesolithic culture of the area. In this connection, it may be pointed out that grains of wild rice have been obtained from Pd. III of Chopani Mando, the late Mesolithic phase, Querns, mullers and handmade pottery have also been found from this horizon. This indicates that while during the late Mesolithic phase people had been collecting wild grains, particularly rice, but in the Neolithic phase the people were cultivating it. Similarly, the prevalence of wild sheep, goat and cattle is recorded from Gravels III and IV and from Chopani Mando in the late Mesolithic Phase. At Mahagara, these animals are found domesticated. The evidence thus suggests that these animals were domesticated from their wild prototypes available in the area

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during the earlier period and were not brought as ready made breeds from outside. The microlithic component of the Vindhyan Neolithic culture also constitutes a running theme from Mesolithic to Neolithic without any break. Thus the combined testimony of Chopani Mando period III, Koldihwa, Mahagara and Kunjhun makes a strong case for a transition from hunting gathering to domestication of plants and animals. The evolution of the Neolithic cultures of the Vindhyas from the Mesolithic is suggested.

Neolithic Cultures of the Mid-Ganga Valley

Explorations conducted in the Middle Ganga Valley have furnished valuable information pertaining to Neolithic culture. The relevant excavated sites include Sohagaura,[92] and Imlidih[93] in Gorakhpur District, Uttar Pradesh, and Chirand[94] (Saran district), Chechar Kutubpur,[95] Taradih,[96] and Senuwar[97] in Bihar. These sites are multi-culture sites and have yielded archaeological relics ranging from Neolithic to the early historical period without interruption.

The excavations, though conducted on a limited scale, have brought to light evidence of wattle and daub structures. Traces of post-holes have been noticed. Screen walls of the huts were made of split bamboo and reed, the impression of which has been preserved on burnt clay limps. At Chirand, evidence of pit-dwelling has also been reported. Evidence of the use of bricks, burnt or otherwise, has not been obtained from any of the sites. The hutments appear to be round or oval on the plan.

The excavations have yielded an enormous amount of data regarding the ceramic industry as practised by the Neolithic folk of the Ganga valley. The available evidence indicates that, in the early stage, they used handmade pottery. The ceramic assemblage includes ordinary red ware, burnished ware (red, grey or black in colour), rusticated ware, black-and-red ware, lustrous red ware and corded ware. In this connection, it may be pointed out that corded ware appears to be a characteristic trait of the Neolithic cultures of both the Vindhyas and of the mid-Ganga valley. The clay used for pottery contains grit-husk and chaff as degraissant. The pottery types exhibit variety, suggesting thereby that the pots were put to different uses. The types include bowls (wide-mouthed, channelled, etc.) with varying profile, vases, vessels, miniature jars, etc. Occurrence of painted sherds has also been reported from Chirand, Senuwar etc. These post-firing paintings, confined to the rim, have been executed in red ochre. At Chirand the painting motifs include linear designs of criss-cross lines and concentric circles. These paintings are, however, confined to burnished grey ware (Senuwar) or grey ware (Chirand).

Needless to say the diversity in ceramic industries and types strongly suggests that the potter had acquired sufficient technical skill in ceramic traditions. Wheel-thrown pots have also been reported from some of the Neolithic sites (Senuwar, etc.) from the upper strata of the culture.

The excavated sites have yielded stone objects in appreciable number. Bladelets, flakes and blades, scrapers, arrowheads, serrated points, lunates, borers, etc. have been obtained from some of the sites. These have been fashioned on chert, chalcedony, agate, jasper, quartz etc. Rounded celts of basalt and granite have also been found from some of the sites (Senuwar, Chirand). The other stone objects include fragments of querns, mullers, balls, hammer-stones etc. Beads, finished and unfinished, have also been obtained from Senuwar and Chirand. These are fashioned on chalcedony, agate, etc. Chirand has also yielded beads of steatite and faience.

Bone objects constitute another trait of the Neolithic culture of the middle-Ganga valley. Excavations at Chirand have yielded plenty of such objects. These include celts, scrapers, chisels, hammers, needles, points, borers, awls, shaft straightners, styli and arrowheads. Bone ornaments like pendants, ear rings, bangles discs, combs, etc. have also been obtained from

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the site. Senuwar has yielded bone points also. In this connection, it may be pointed out that, with the exception of Neolithic sites of the Kashmir Valley, Chirand is the only Neolithic site of India to produce bone objects both in quantity and variety.

Terracotta objects have also been obtained from the Neolithic sites. Senuwar has yielded edge-ground potsherds (triangular or rectangular in shape), spherical beads with central perforation etc. To Chirand goes the credit of yielding terracotta wheels, beads, bangles, terracotta cakes, birds, serpents, etc.

The Neolithic people of the middle-Ganga valley had been cultivating wheat, barley, rice, field pea, lentil, masoor, moong, etc. The evidence from Senuwar and Chirand is copious. A casual glance at the list of cultivated grains clearly indicates that they were producing not only such crops as could have been produced in the rainy season alone, but winter crops also. Rice appears to be the staple food of the people.

Bones of ox, buffalo, elephant, rhinoceros, stag, deer etc. have also been found from the excavated sites. Of these ox and buffalo were certainly domesticated. Stag and deer might have been hunted. As the rhinoceros has never been domesticated, during the Neolithic phase also it would have roamed wild in the marshy areas of the middle-Ganga valley. Whether elephant was domesticated in that dim distant past, cannot be inferred in the present state of our knowledge. However, the possibility of its having been domesticated cannot be ruled out as the animal was available in the area and the earliest domestication of elephant might have taken place in India and India alone as per the available evidence.

For fixing the chronology of the Neolithic culture of the Middle Ganga Valley, the C14 dates of Chirand and Senuwar may be taken into consideration. Two dates reading 1760 ± 150 BC and 1680 ± 135 BC[98] push back the beginning to the Neolithic culture to around 2000 BC at Chirand. From the overlap phase of Neolithic-Chalcolithic at Senuwar four dates reading 1770 ±120 BC 1660 ± 120 BC, 1500 ±110 BC and 1400 ±110 BC have been obtained.[99] This would push back the beginning of Neolithic culture at the site to earlier than 2000 BC.

Neolithic Culture of South-east India

Neolithic artefacts were collected from the Chotanagpur plateau in Bihar and the adjoining area of Orissa.[100] Reverend Bodding,[101] of the Norwegian Mission collected such tools in plenty. The artefacts include axes, adzes, mullers, hammer stones, along with some microliths. Subsequent explorations in the area resulted in the discovery of a variety of artefacts comprising chisels and axes with round butt ends, wedges, ringstones, hammer stones, faceted tool, axes with splayed edges, bar-chisels etc. These are fashioned on a variety of rocks like phyllite, epidorite, gneiss, sandstone, basalt, quartzite, slate and limestone. For fabricating the artefacts, chipping, pecking, grinding and polishing techniques have been employed.

Of the excavated sites of the region under discussion mention may be made of Barudih[102] and Dagui[103] in Bihar and Golabai Sasan,[104] Sulabhdihi[105] and Kuchai[106] in Orissa. The archeological deposit at Barudih is divisible into two distinct phases of which the earlier one, i.e., phase I, may be ascribed to the Neolithic. This phase has yielded polished axes, adzes and other stone objects along with charcoal and handmade pottery. The celts obtained from the site are divisible into trapezoidal, triangular, sub-triangular and oval forms. The other stone objects from the site include pounders, hammer stones, fabricators, ringstones and querns.

Dugui, located at as distance of 3 km to the east of Barudih, has yielded adzes, chisels, scrapers, hammer stones, pounders, ringstones and querns.

Golabai Sasan, situated on the left bank of the Mandakini in Puri District of Orissa, has yielded objects divisible into two groups: Pd. I Neolithic; Pd. II with two sub groups – IIA Chalcolithic, Pd. IIB Iron age.

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Axes, adzes, chisels and querns have been obtained from the Neolithic horizon. One example of shouldered celt has also been found. Besides the stone tools, the site has also yielded tools fashioned on semi-mineralized bones and antlers. The tools include points, burins, chisels, adzes, needles, arrowheads and harpoons. The other finds of the phase comprise sherds of handmade pottery and animal bone fragments, The animal species identified include cattle, sheep, goat and stag. Of these, cattle, sheep and goat may have been domesticated.

Sulabhdihi (Bonaigarh Subdivision in the Brahmani valley, Orissa) has yielded plenty of celts, both complete and broken. These are divisible into adzes and chisels. Kuchai (Mayurbhanj District, Orissa) excavated by Thapar exposed two cultural horizons: non-geometric microliths without pottery at the bottom and a Neolithic horizon without microliths. No overlap is reported between these two cultural horizons. The polished celts obtained from the Neolithic phase include celts with rounded butt-ends and rectangular cross-section; faceted hoes, chisels and pounders; fragments of mace-head (ringstone) and grinding stones. These Neolithic objects were found along with a coarse gritty red ware divisible into two fabrics – medium to thick and medium; to thin, the former constituting the majority. The pots of the thicker fabric were handmade, the thinner variety appears to have been thrown on a turntable or a slow-wheel. The available pottery types include bowls, vases and lids with solid knobs. Evidence of red slip was also discernible on some of the pots. Of the available decorative motifs mention may be made of finger tip and incised patterns.

From the aforesaid, it would be evident that as no Neolithic site in this group has been excavated horizontally, the data available are scanty. Most of the celts have come as surface finds. However, even the meager excavated material has been able to put the celts in proper archaeological context. It appears that the Neolithic people of this zone had started domesticating cattle, sheep and goat. They still indulged in hunting. Though no grain has been obtained to throw light on cultivation, the occurrence of querns and mullers at these sites, along with handmade pottery, makes a strong case for the prevalence of agriculture among these people.

Neolithic Culture of North-eastern India

From the point of view of the Neolithic celts, north-eastern India constitutes a distinct zone. Neoliths have been collected from this region right from the middle of nineteenth century.[107] Dani,[108] on the basis of raw material and tools types, divided the region into six geographical units. As per his classification, the tools of the region are classified into faceted tools, shouldered celts, splayed edge axes, round-butt axes, wedges and grovedstones. Krishnaswami[109] opined that faceted tools, shouldered axes and splayed axes, on account of their abundance in South-east Asia, appear to have been introduced into North-eastern India from that area. Sharma,[110] taking into consideration the technological aspects, has divided the Neolithic tools into edged, ground, pecked and ground, fully ground, and miscellaneous categories. On the basis of shape, cross-section, size and function, these tools are further divided into sub-groups. Sharma has classified the tools into sixteen types. However, these are placed in three main groups: edge ground, pecked and ground, and pecked and fully ground implements. The tool types include the large axe, tanged axe, round-butt axe, wedge-shaped axe, quadrangular axe, rounded chisel, and rounded edge. These tools are fashioned on river pebbles of fine-grained rock-like jadeite.

To understand the archaeological context of these tools excavations were conducted at Daojali Hading,[111] Saru Taru[112] and Marakdola.[113] All these sites have yielded cord-impressed potsherds. The finds of Deojali Hading deserve special mention.

The available evidence suggests that the Neolithic settlers occupied virgin soil at the site. Four stages of cultural development have been reported: Hoabinhian, Early Neolithic, Late

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Neolithic, and Aneolithic. The ceramic assemblage of the site is divisible into three groups; coarse grey with quartz particles, dull red, and brick-red, the first being preponderant. The red pottery is in thin fabric and is butter-fired. The grey were is cord-impressed. No shapes could be worked out as the sherds were found in small pieces.

The stone objects consist of small celts, adzes, chisels, shouldered celts, grinding stones, querns, mealing troughs, mullers and quartzite pebbles fashioned on sandstone, shale, quartzite and fossil wood.

The occurrence of burnt-clay lumps with reed impressions suggests that the Neolithic people probably lived in hutments of wooden frame. The walls of these hutments made of split bamboo and reed used to be plastered from both the sides.

Evidence of grains and animals has not been found. However, on the basis of the occurrence of querns, mullers, mealing troughs and shouldered axes in course of excavation, the prevalence of some kind of agriculture is suggested.

The cord-impressed grey ware along with shouldered celts and small celts with round or flat sides is related to the east-Asian Neolithic tradition. These are found in similar contexts in south-west China and Indo-China.[114]

South Indian Neolithic Cultures

Among the Neolithic cultures of India, the South Indian Neolithic is the best studied one. This culture is spread over Karnataka, Andhra Pradesh and Tamil Nadu. The geographical zone of the culture is bounded by the Bhima in the north, the Kaveri in the south, Hallur (Karnataka) in the west and Nagarjunakonda and Kesarapalli in the east.[115] Among the excavated sites pertaining to this culture, mention may be made of Brahmagiri,[116] Sangankallu,[117] Piklihal,[118] Maski,[119] Tekkalkota,[120] Hallur,[121] Utnur,[122] Kupgal,[123] Kodekal,[124] Palavoy,[125] T. Narsipur,[126] Hemmige,[127] and Nagarjunakonda.[128] Allchin[129] and Paddayya[130] think that the ash-mound sites, Utnur, Kupgal, Kodekal and Palavoy, all falling in the state of Karnataka, constitute the earliest horizon of the Neolithic culture of South India. This phase is represented by polished celts and blade traditions, domestication of cattle, sheep and goat and handmade pottery with grey or buff-painted decoration, The grey ware of the assemblages often exhibited post-firing red ochre bands. The occurrence of quern/muller fragments suggests cultivation or gathering of wild cereals.

The second phase is represented at Piklihal (Upper Neolithic), Brahmagiri, Sangankallu, Tekkalkota I and Hallur IIA. Hallur I and T. Narsipur, according to Allchin should be placed in the beginning of the phase.[131] During this period, people made their settlements on the tips of granite hills or on leveled terraces on the hillsides or on saddles or plateaus between such hills. Circular hutments with wattle and daub are evidenced. The stone axe and blade industries are the connecting links between this and the earlier phase, the former exhibiting refinement. The ceramic industry shows continuity, variety and refinement. The first metal objects – copper and bronze – appear towards the end of this phase.

The third phase[132] comprises Tekkalkota II, Hallur, Paiyampalli,[133] Piklihal, Sangankallu 1.2 and Brahma girl (not described in the excavated section). The phase registered an increase of copper/bronze objects. The stone axes and blade industries persist. The wheel-thrown unburnished ware with purple paint characterises this sub-phase. Horse-bone (Hallur) and exotic metal objects (Kallur swords) are also ascribed to this phase.

Paddayya feels that the hilly tract of Bellary and Raichur Districts and the Shorapur Doab, constituted the nucleus zone of the culture. But by 1900 BC it started diffusing west, south and east, leading to the growth of local variants. He has postulated five variants.[134]

Variant I is represented at Utnur (period I to IV), Piklihal (Lower Neolithic), Kodekal (layer 4 to 6) and Brahmagiri IA. The period saw the introduction of black-and-red ware, metal objects and wheel-thrown black painted pottery.

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In Variant 2, represented by a group of more than 30 sites in the Upper Krishna basin, besides the recurrence of polished stone axes, blade tools and grey pottery, recalling the Kayatha culture is noteworthy. Painting, executed in black, white or reddish-brown on red or grey background, recalling the Savalda ware, has also been found at some sites.

Variant 3, marking the southern extension of the culture, has been located in the upper reaches of the Tungabhadra and Kaveri rivers. The excavated sites of the group are: Hallur, T. Narsipur and Hemmige. The sites of the group are found spread along with the river courses. Pottery neck-rests appear to be a special feature of this variant. Absence of ash mounds and the impoverished nature of the blade industry are also note worthy in this variant.

Variant 4 is represented by the sites found in or around Anantpur District (Andhra Pradesh). So far more than 50 sites including 10 ash-mounds, are ascribed to this variant. Palavoy and Nagarjunakonda are the excavated sites. The assemblage is characterized by a profusion of stone axe and blade industries. The main ceramics of the variant are blotchy grey were and dull red ware. Painted sherds are also met with. The occurrence of bone tools in profusion in this group is noteworthy.

Lying immediately to the north-east of the Variant 4 zone is a cluster of sites spreadover in the eastern part of Kurnool and the adjoining Cuddapah Districts which constitute Variant 5. The ceramic assemblage here is marked by black-on-red pottery, the so-called patpad ware. The occurrence of cream-slipped and black-and-red wares and the dominance of red ware over grey ware are the other traits of the variant. Workshops of disc beads of steatite are also reported from some of the sites. No ash-mound is represented from the zone.

In the following pages, a syncretic view regarding the Neolithic culture of South India is attempted.

The Neolithic culture is marked by circular hutments, The wattle and daub structures are indicated by the occurrence of burnt-clay lumps with bamboo or reed impressions. Like the huts of tribal people to day inhabiting the surrounding areas, these huts were also provided with conical thatched roofs, Occasionally, rectangular structures and subterranean pits are also met with. Nagarjunakonda has provided this type of evidence, At some sites the boundaries of the hutments are demarcated by granite boulders. Hearths and storage jars are met with in practically all the huts. The floors of the huts were occasionally white washed with lime, small pits used to be dug for receiving the rubbish. The available evidence would indicate that the dwellings of these people were very modest. No evidence of brick or mud structures has yet been obtained.

The Neolithic sites furnish plenty of stone tools divisible into two groups : picked and ground industry and blade industry. The first fashioned on coarse-grained rocks like dolomite, sandstone, granite, etc., is further sub divisible into two-edges tools and non-edge tools. The first sub-group comprises axes, adzes, chisels, wedges, chipping tools, scrapers etc., the most common being the triangular axe with oval cross-section and rounded or pointed butt-end. As raw material was locally available the tools were manufactured at most of the sites, as is evidenced by the occurrence of raw material, debitage and finished and unfinished tools. The non-edged tools include hammer stones, querns and mullers. Sling balls are also met with.

The blade industry constitutes an important feature of South Indian Neolithic culture. Fashioned mostly on chert, blades as blanks have been obtained from core through the punch technique. These blanks used to be converted into a number of tools: backed and serrated blades, points, lunates, trapezes, borers etc. A majority of the blanks might have been put to different uses without any modification. These tools would have been used as sickles, arrowheads, etc. At Nagarjunakonda, Sangankallu and Palavoy, there are microlithic horizons preceding the Neolithic horizon. As there is no direct succession, it cannot be said that stratigraphically the Neolithic culture succeeded the Mesolithic at the sites. However, the

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possibility of this cannot be ruled out. Axes, chisels and points made of bone or shell have also been obtained from some of the sites. In this context, Palavoy deserves special mention.

From the Neolithic sites ascribed to phase I, only handmade potsherds are obtained. However, in the late phase, i.e., Phase II, wheel-thrown pottery is also found. The pottery of Phase II comprises pale grey, grey-brown and buff coloured potsherds. The firing was not fully controlled. Of the shapes available in this phase, mention may be made of bowls of various shapes: shallow dishes, lipped, lugged, spouted, channel-spouted, handled and hollow-footed bowls, jars, dishes-on-stand and perforated pots. For decorating the pots, painting, perforation and appliqué methods have been resorted to. The painting is executed in purple over a red or buff surface. The limited number of motifs painted include radiating triangles and wavy lines. The pottery of phase II is remarkable from many points of view. On the one hand, it registers the disappearance of unburnished grey and brown wares and a paucity of burnished grey ware. On the other hand, the appearance of dull red ware and black-and-red ware is recorded. The clay used for manufacturing the pots is gritty. The dull red ware was occasionally found painted in black or violet. The black-and-red ware is also occasionally painted in white pigment. As is but natural, the Neolithic culture of south India at some sites in its late phase was in contact with the Jorwe culture of Maharashtra, as would be evident from the occurrence of common pottery types, e.g., spouted dull-red vessels, jars with constricted necks; ovalish lamps, etc., in both the cultures.

A corpus of beads has also been obtained from the Neolithic horizons. Phase I has yielded only shell beads but it appears that with the passage of time, the Neolithic people not only widened the range of raw material used for the manufacture of beads but also registered a refinement in the lapidary art which is clearly discernible. From phase II, beads of steatite, agate, carnelian, terracotta, gold and copper have been obtained. Copper ornaments comprising bangles, spirals and pins have been found in Brahmagiri, Tekkalakota and a few other sites. Tekkalakota and T. Narsipur have yielded gold objects like pendants and beads.

Evidence pertaining to the disposal of the dead has also been obtained from some of the sites. Unlike the Harappans, these Neolithic people used to bury their dead within the habitation area and often within the residences themselves. The available data indicate the prevalence of extended and partial burials. In the former, the adults were buried in a prepared grave with their skeletons placed in an extended position. In fractional burials, only a few bones of the dead were collected and buried. Children were buried in one or two urns placed face to face in a horizontal position. From some of the graves a few pots and ground axes placed as burial goods were obtained. The dead were generally placed in north-south direction, with the head lying to the north.

The Neolithic people exhibited their aesthetic feelings through their artistic activities. These include painting, pecking and bruising on granite terraces and hills. The paintings are executed in white or red colour. Painting and bruised motifs comprise deer, gazelle, sheep, goat, horse, bull and palm.

The Neolithic sites have yielded a corpus of animal bones. The species identified include rat, hare, tortoise, monitor lizard, spotted deer, stag (barasingha), nilgai, black buck, gazelle, sambhar, cattle, buffalo, sheep, goat, horse, dog, pig, fowl and ass. Of these, the last nine were domesticated. The occurrence of charred and split bones of animals in profuse quantity at these sites clearly demonstrated that the flesh of these animals was eaten by the Neolithic people. The available evidence suggests that hunting still played a dominant role in the economy of these people. According to Alur, the exostosis of skeletal parts and anchylosis of the hock-joints indicates their use as pack animals.[135]

Though largely depending on stock raising and hunting, the Neolithic people had become cultivators as well. Of the grains found at excavated sites mention may be made of horsegram (*Dolichos biflorus*), finger-millet or rāgi (*Eleusine coracanna*), green gram (*phaseolus*

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radiatus), bulrush millet or bajra (*Pennisetum typhoideum*), great millet (*Holcus sorghum*), and legumes. Date palm, zyzyphus and accaciasp are also reported from Hallur. Of these ragi, jowar and bajra are thought to have been first cultivated in Africa as their wild varieties are available there but not in India. It is not precisely known how and when these were introduced in India.

For computing the chronology of the South Indian Neolithic culture, it may be observed that, stratigraphically speaking, it is preceded by the Mesolithic culture and succeeded by the Megalithic culture. In its later phase, this culture shows contacts with the Jorwe culture of Maharashtra. C14 dates are available from Hallur, Kodekal, Paiyampalli, Palavaya, Polakanda, Sangankallu, T. Narsipur, Tekkalakota, Terdal and Utnur. The combined testimony of these dates suggests a time bracket ranging from 2500 BC to 1000 BC.[136]

The foregoing discussion about the make-up of the Neolithic culture of different parts of India indicates:

(1) All the Neolithic cultures share a polished celts tradition, with varying percentages.
(2) The Mesolithic blade components are confined to the Neolithic cultures of north-west India, Vindhyan area, South India and, to some extent, the middle-Ganga valley.
(3) Bone tools are conspicuous in North Indian Neolithic sites and at Chirand in the middle-Ganga valley. These are occasionally reported from the north-western region and South India also. In the context of the latter, particular mention may be made of Palavoy.
(4) Domestication and cultivation are recorded in the north-west, the North Vindhyan area, the middle-Ganga valley and South India. Domestication is also suggested in south-eastern India while cultivation is suggested in north-eastern India.
(5) Pit-dwelling is a characteristic feature of the Neolithic culture of Kashmir. However it is also recorded at Sarai Khola in the north-west and Nagarjunakonda in the South as well.
(6) Handmade cord-impressed pottery is reported from the Neolithic sites of the Vindhyas, the middle-Ganga valley and north-east India.
(7) Burials are reported from the north-west, north and south Indian sites.
(8) Burials of pets are reported from the Neolithic sites of Kashmir alone.
(9) An aceramic stage is represented in the north-western and north Indian sites alone

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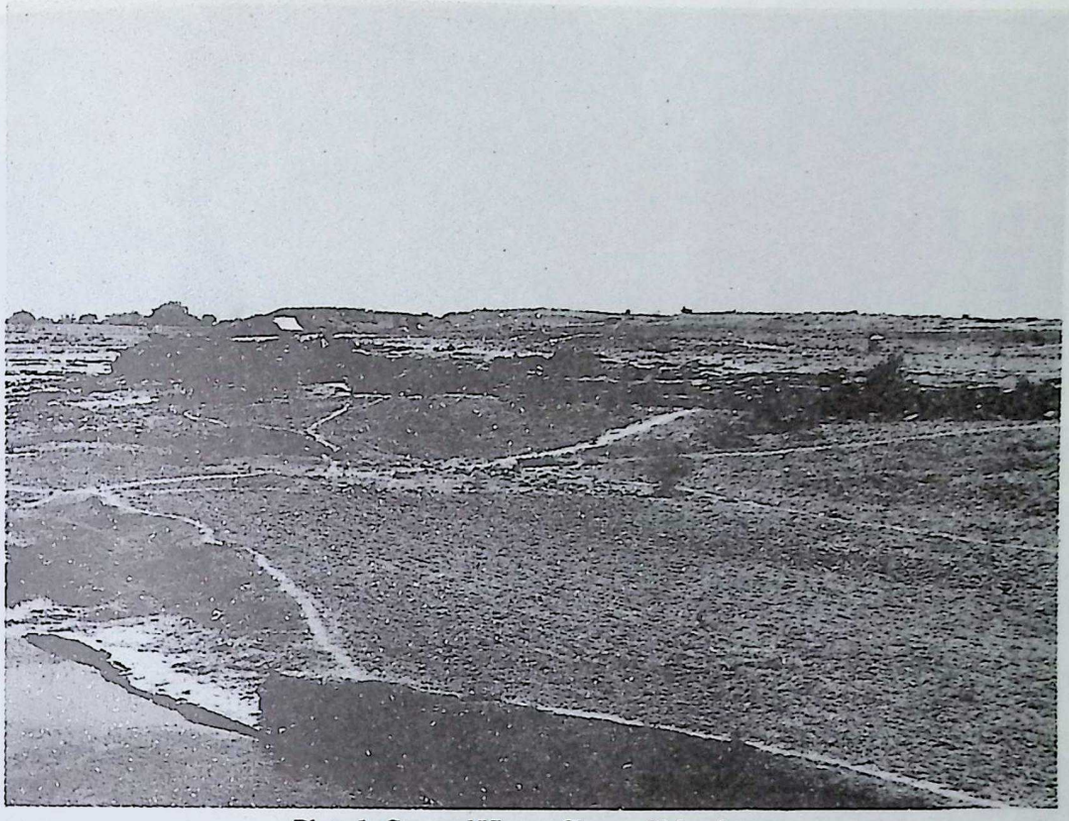

Plate 1: General View—Chopani Mando

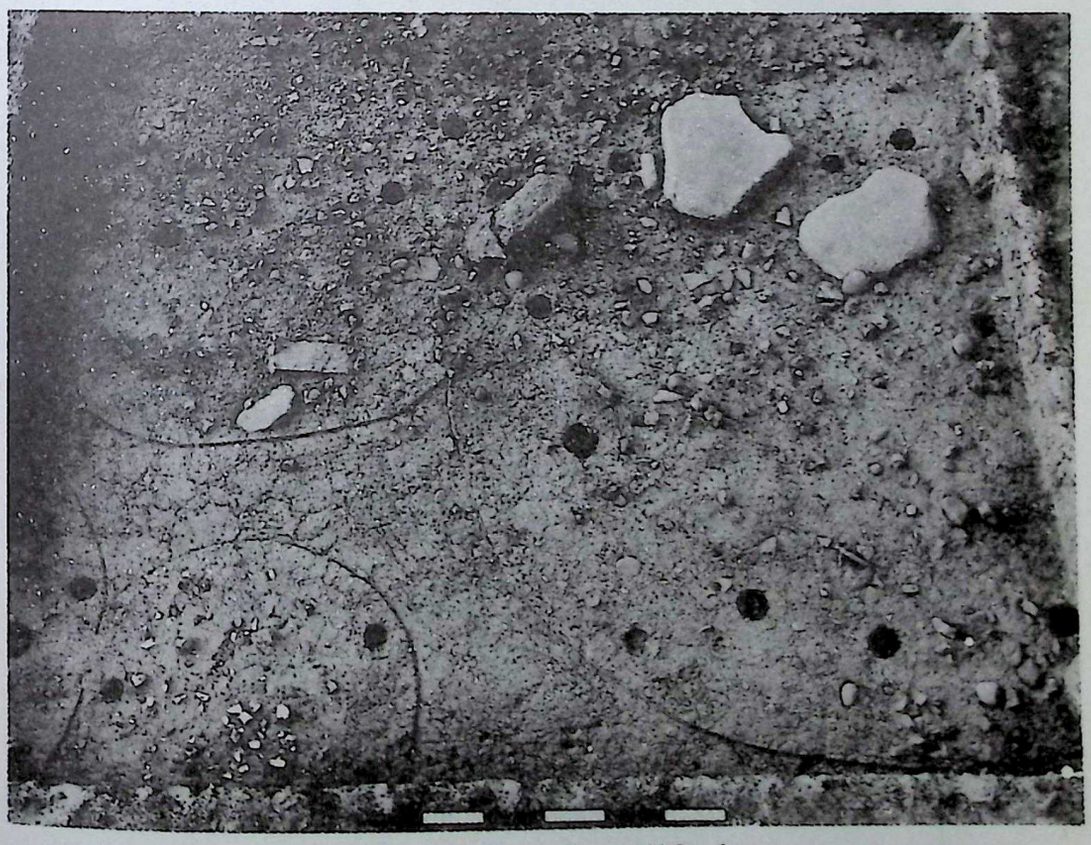

Plate 2: Hut Floor, Chopani Mando

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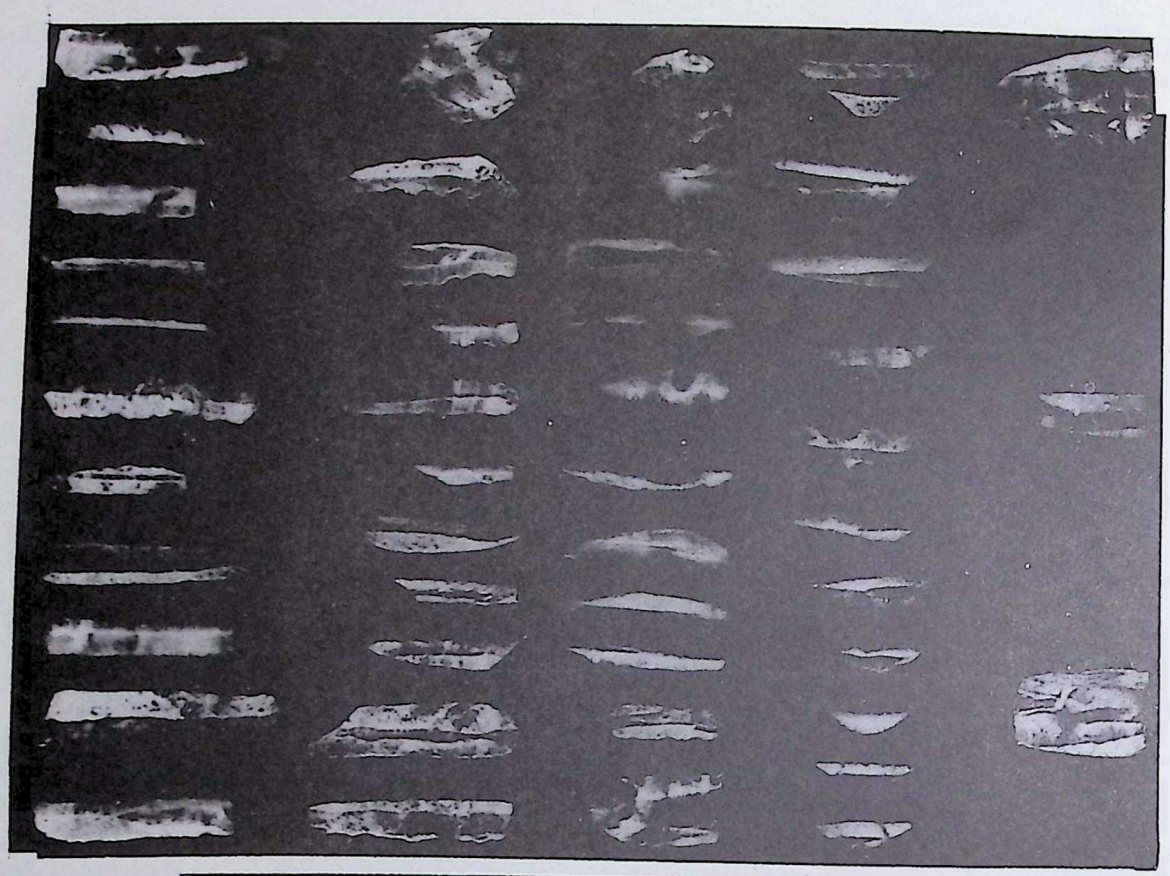

Plate 4: Chopani Mando, Phase III

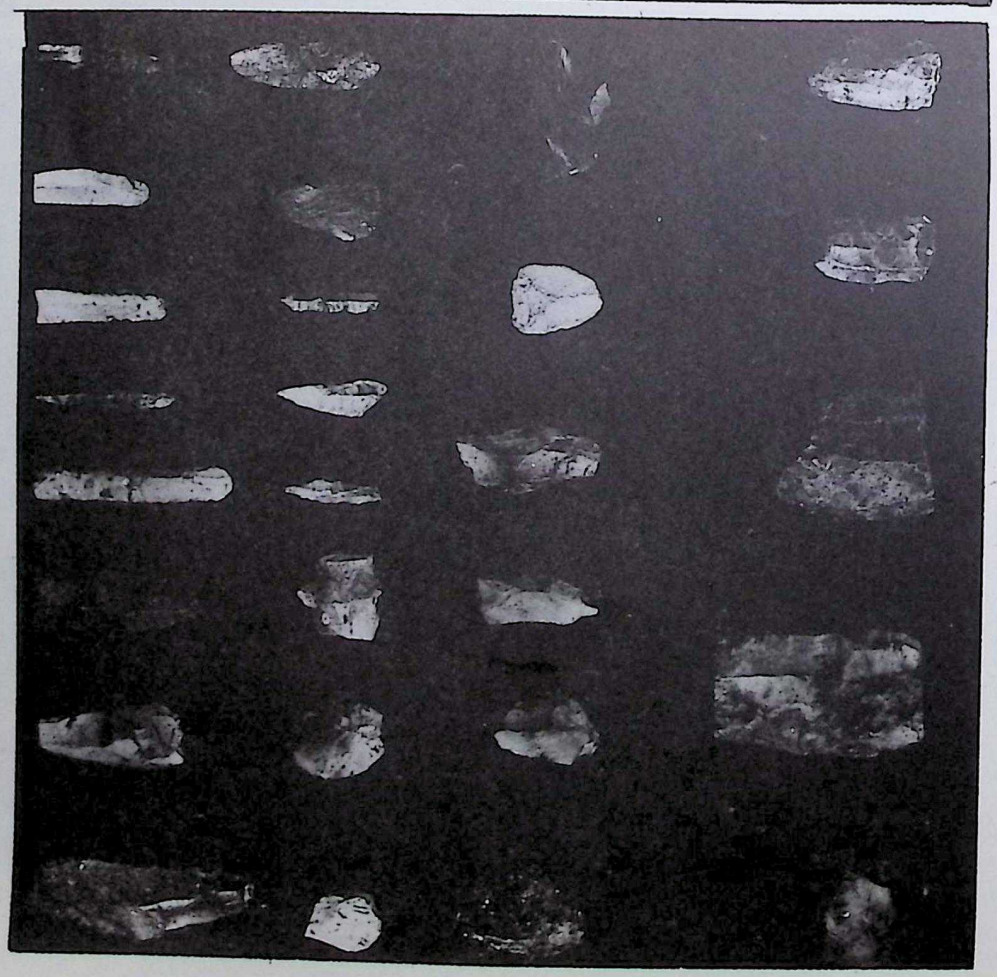

Plate 3: Microliths: Non Geometric Prepottery, Chopani Mando

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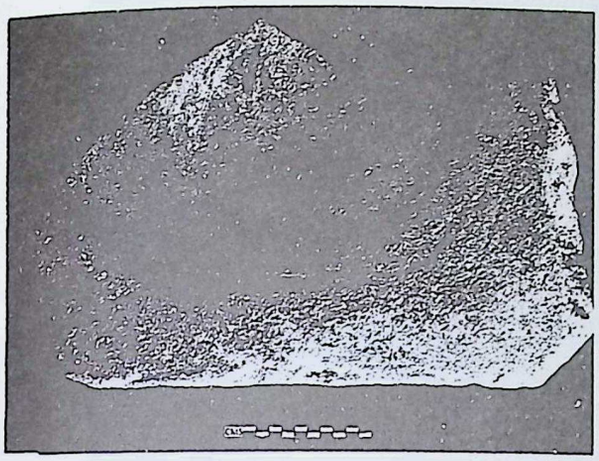

Plate 5: Quern Fragment, Mahadaha

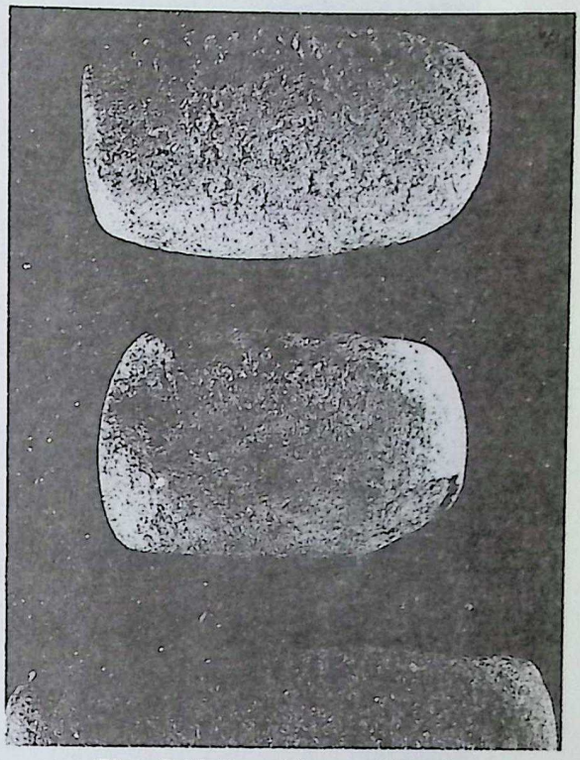

Plate 6: Mullers, Chopani Mando

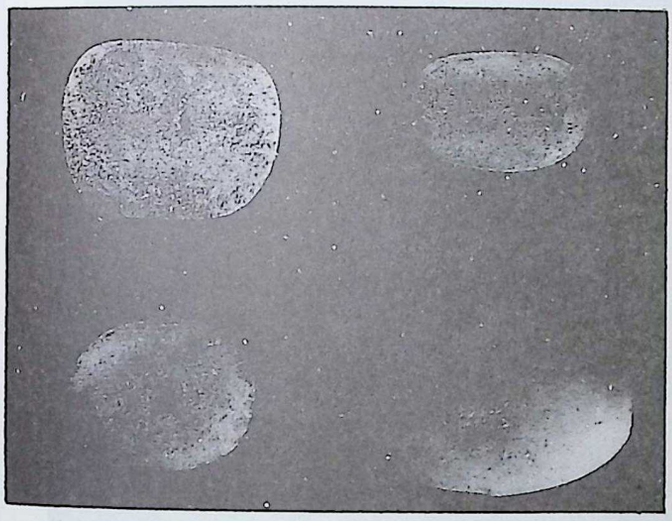

Plate 7: Anvils, Chopani Mando

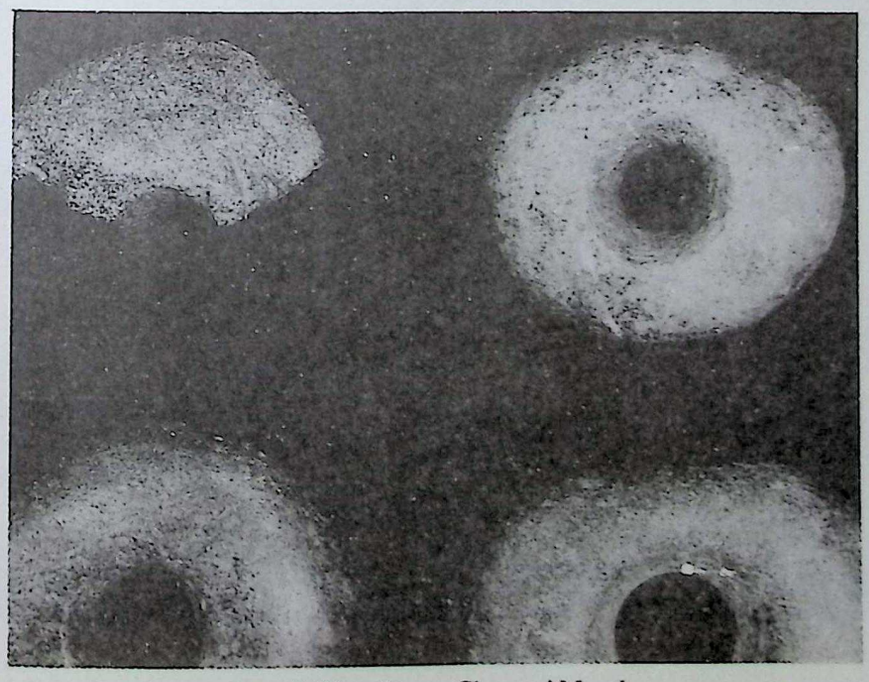

Plate 8: Ring-Stone, Chopani Mando

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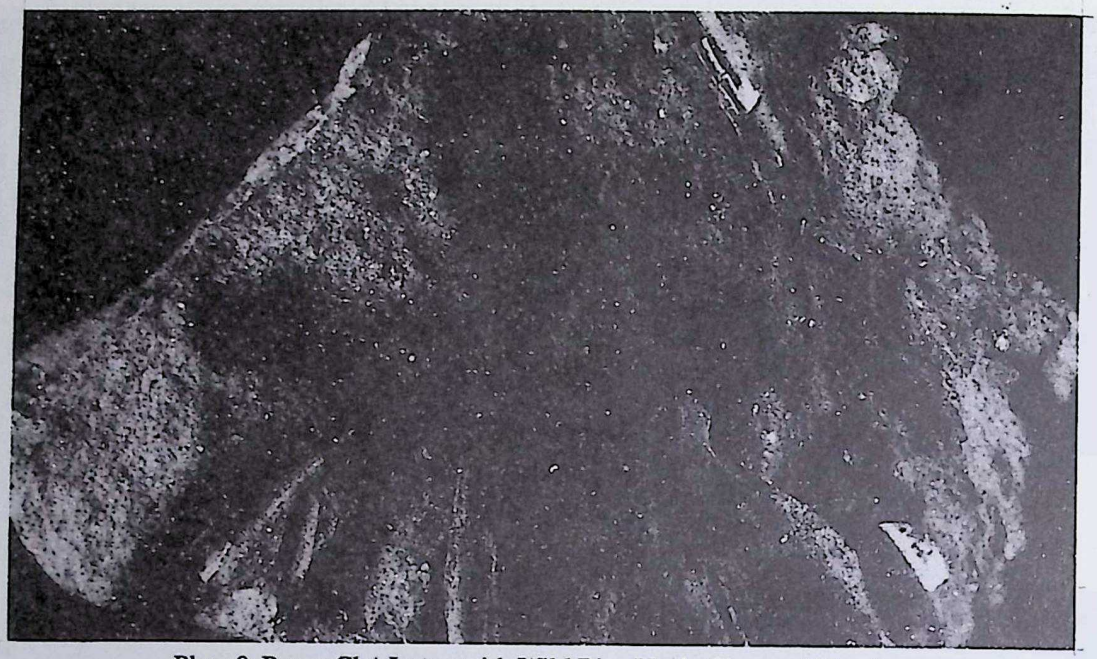

Plate 9: Burnt Clay Lump with Wild Rice-Husk, Chopani Mando

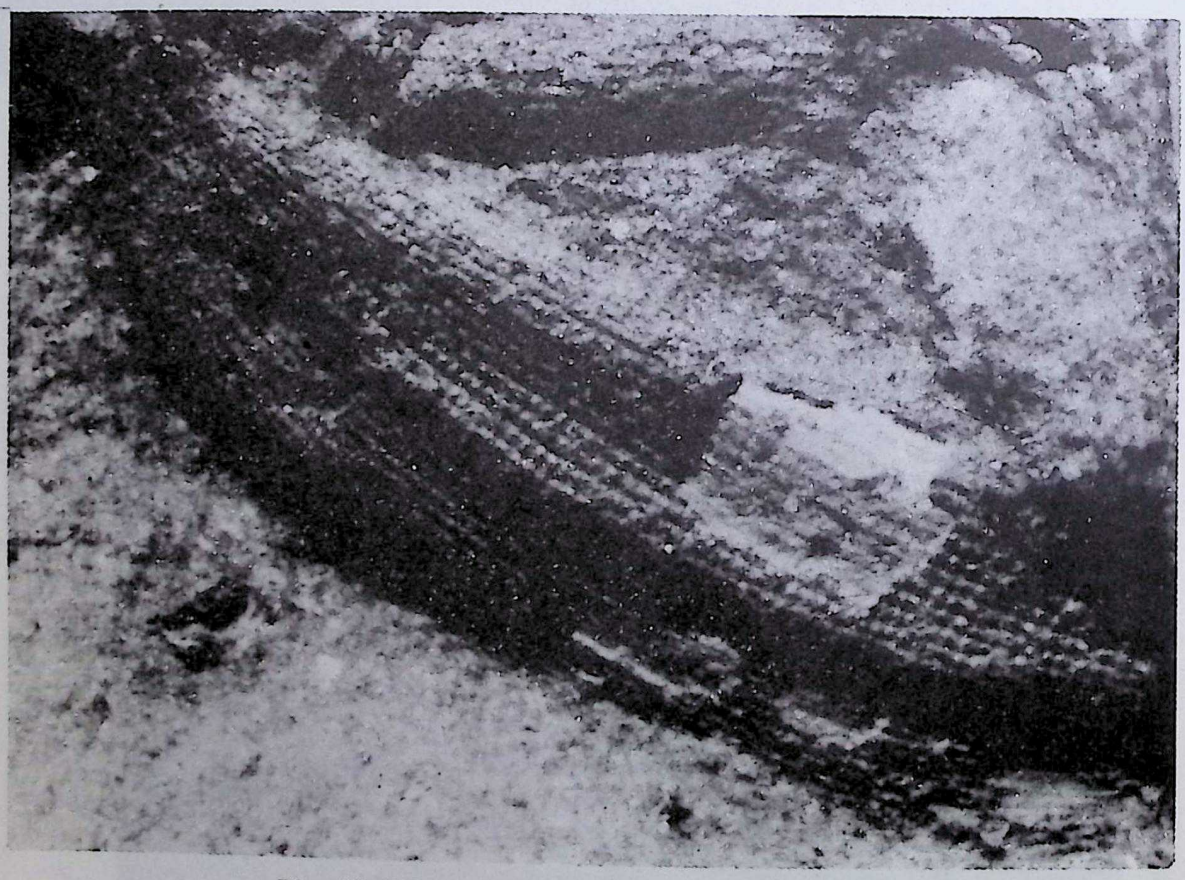

Plate 10: Close up of Wild Rice-Husk, Chopani Mando

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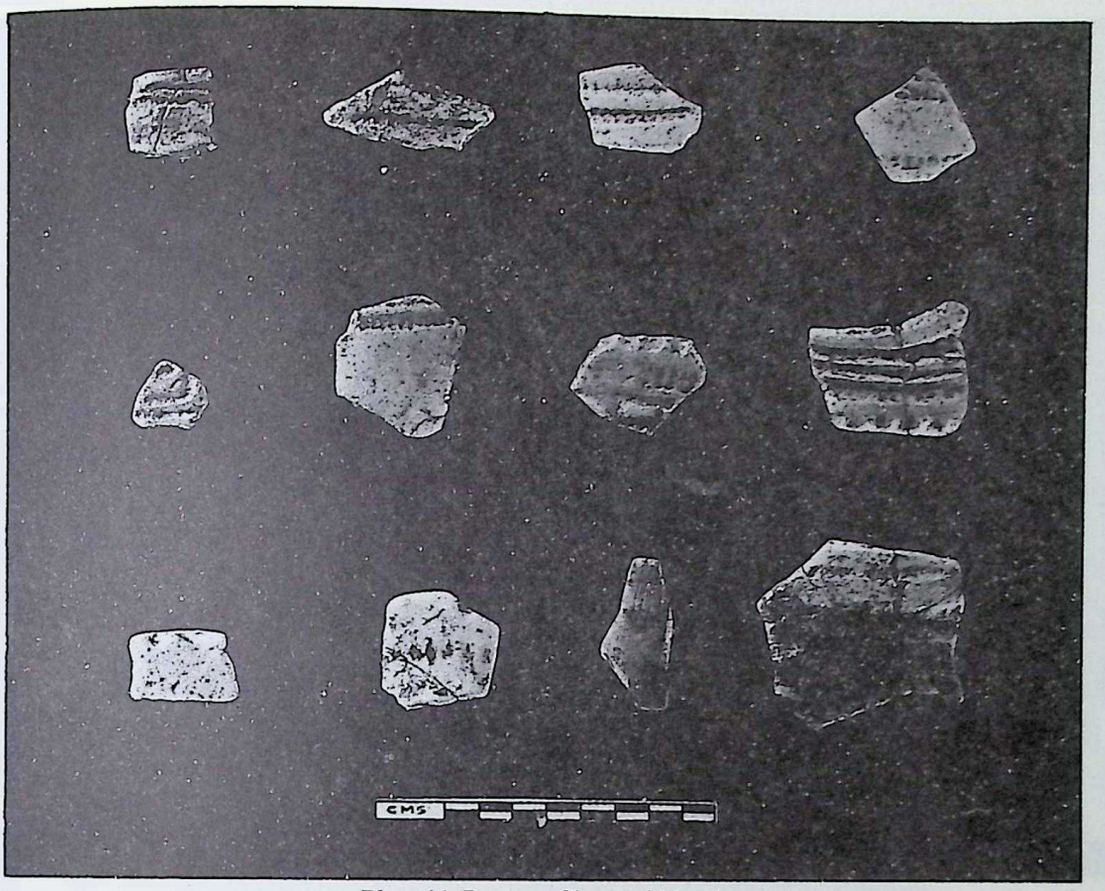

Plate 11: Pottery, Chopani Mando

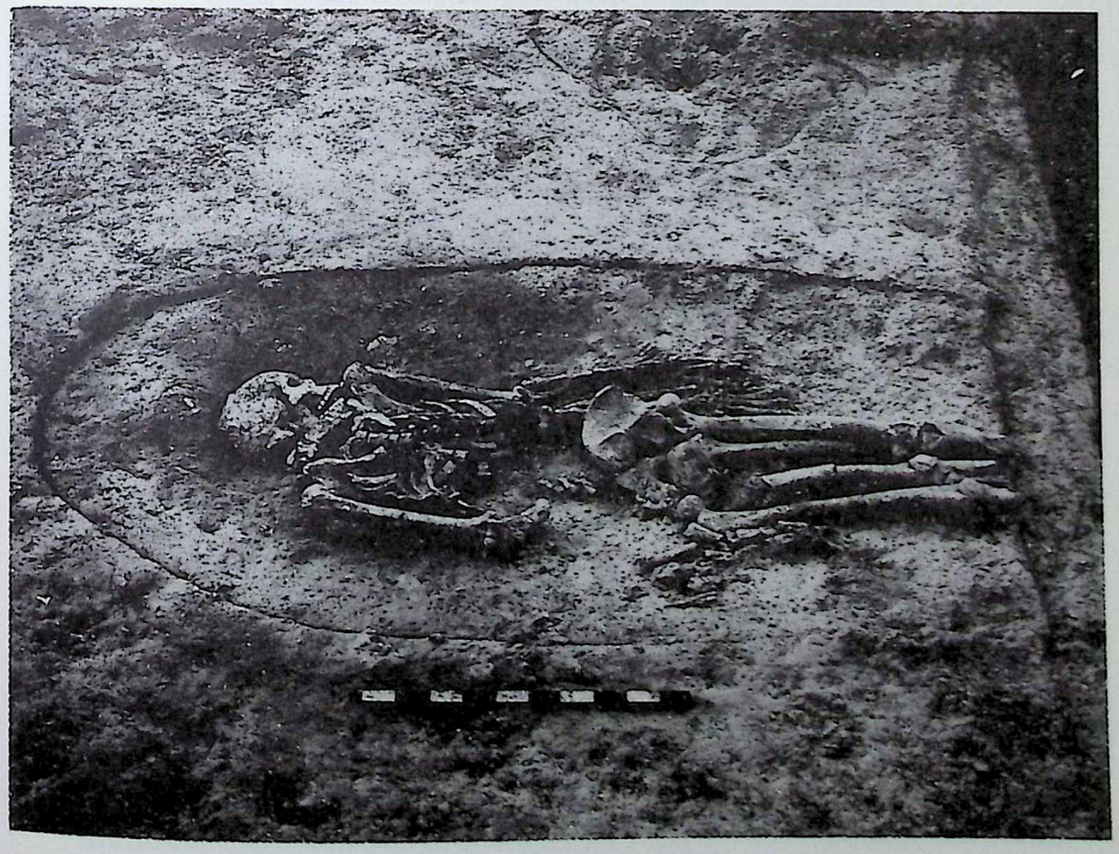

Plate 12: Double Burial, Mahadaha

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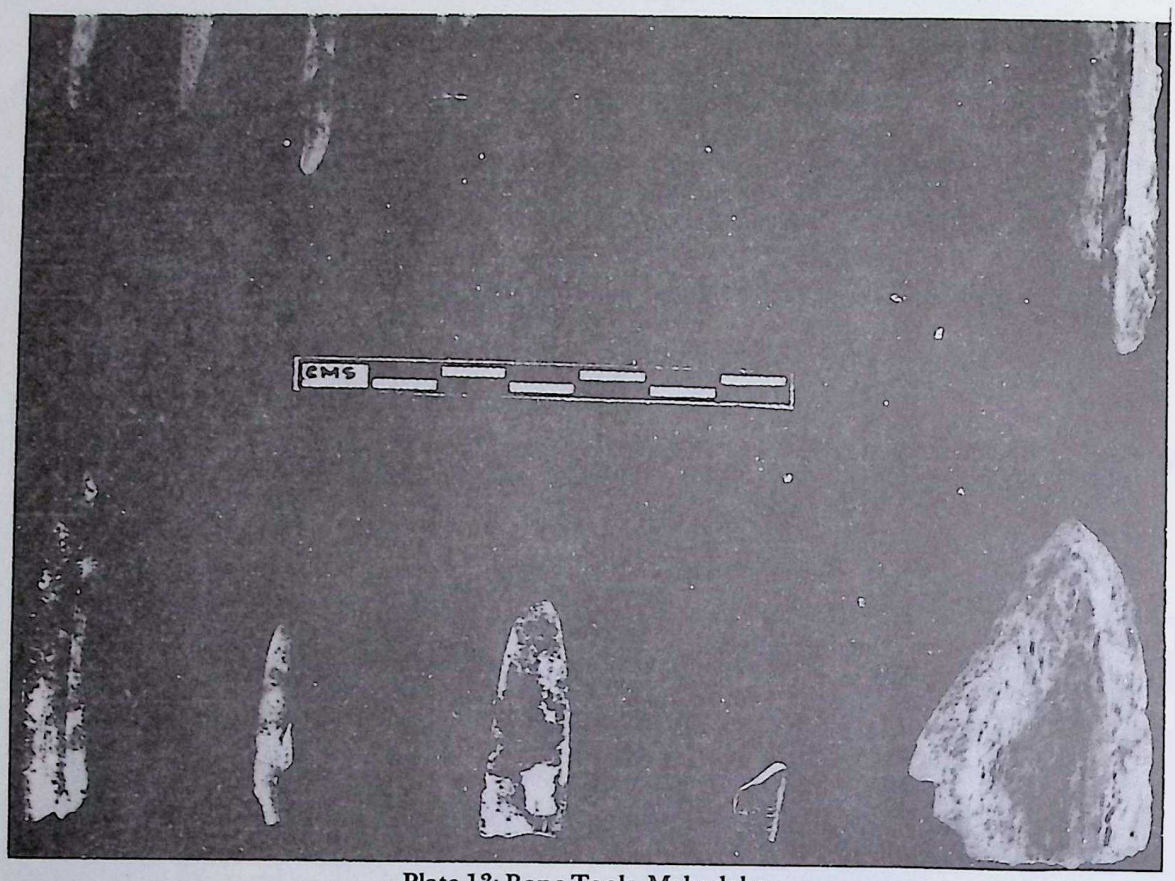

Plate 13: Bone Tools, Mahadaha

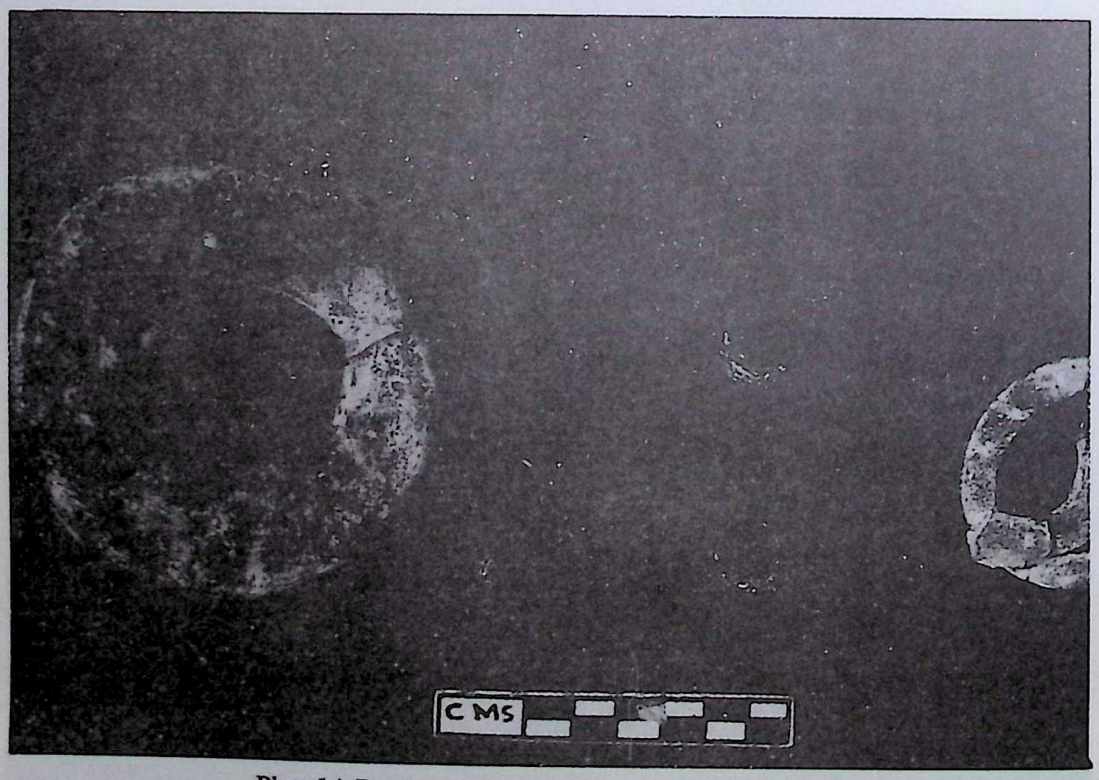

Plate 14: Beads with Ring made of Bone, Mahadaha

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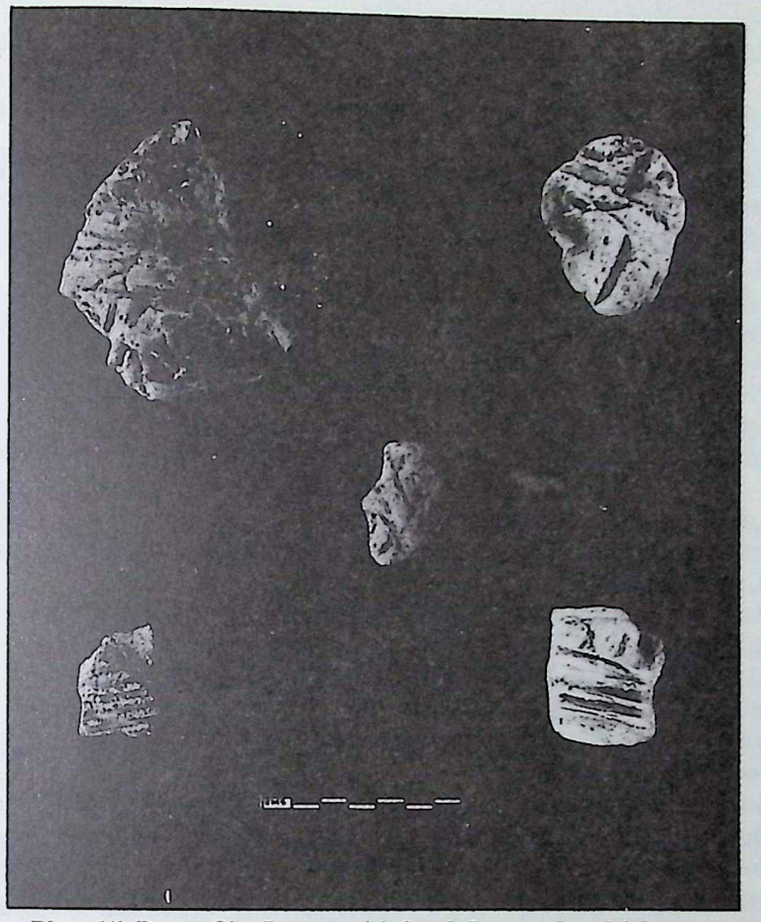

Plate 15: Burnt Clay Lumps with Seeds Impression, Mahagara

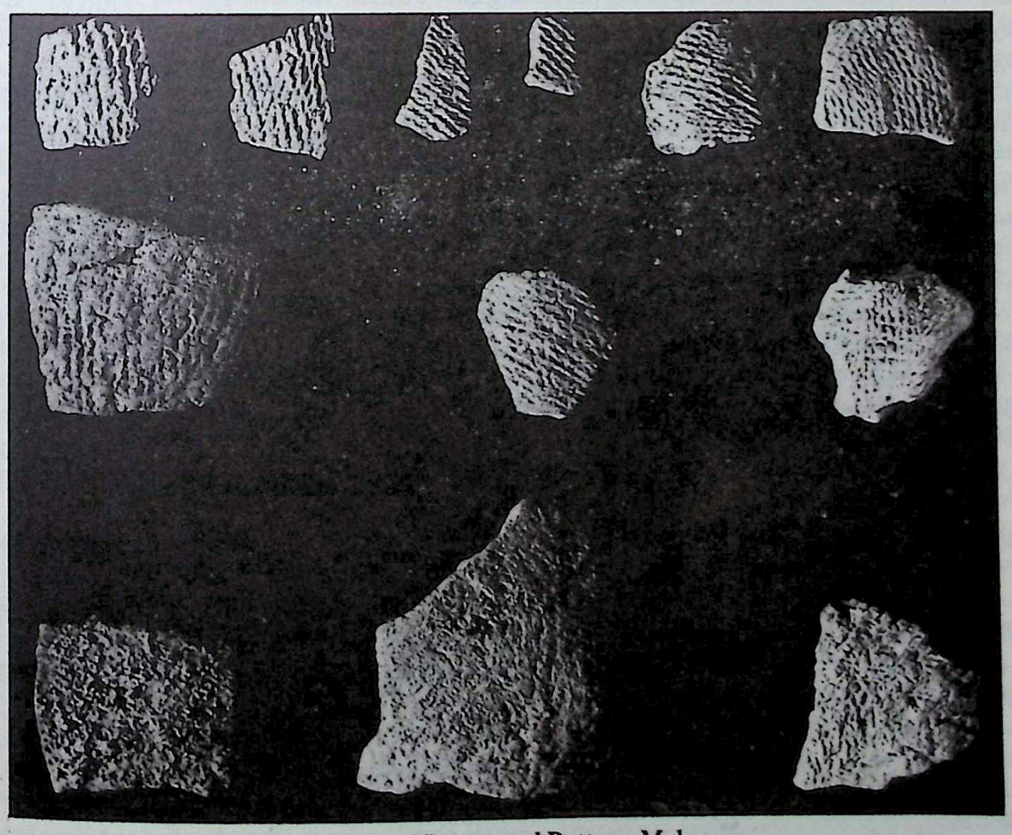

Plate 16: Cord Impressed Pottery, Mahagara

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SECTION IV

PROTO-HISTORY (HARAPPAN AND CHALCOLITHIC CULTURES)

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CHAPTER XI

The Indus-Sarasvatī Civilization: Beginnings and Developments

S.P. Gupta

THE INDUS-SARASVATĪ CIVILIZATION: THE BEGINNINGS

What is generally called the 'Indus' or the 'Harappan' Civilization and used as interchangeable terms for the fourth-third millennium Bronze Age Indian Civilization is here called the 'Indus-Sarasvatī Civilization'. The reason for the change in nomenclature lies in the most startling archaeological discoveries made during the last two decades by Rafique Mughal[1] (Fig. 1).

These discoveries were made in that part of the Lost Sarasvatī basin which lies in Cholistan deserts of Bikaner located in the Bahawalpur region of Pakistan, adjoining north-western Rajasthan (Fig. 2). This has now firmly established the primacy of the Sarasvatī river over the Indus in terms of concentration of the Indus sites of different categories—Camp sites, Industrial sites, Village sites and Cities. Here Mughal has found the remains of as many as 363 sites of this civilization (Fig. 3). His conclusions were supported by similar discoveries made in India. J.P. Joshi, R.S. Bisht, Suraj Bhan and others have discovered around 250 sites in the basin of the Sarasvatī and its several tributaries such as the Dṛṣadvatī, in north-eastern Rajasthan, Haryana and western Uttar Pradesh[2] (Fig. 4). Thus, there appears to be more than 600 sites on the Sarasvatī and its tributaries in India and Pakistan (Fig. 5). And certainly there are many more awaiting the spade of archaeologists (Fig. 6). But, on the other hand, there are not even 150 sites on the Indus and its tributaries, including those more than a dozen sites which Mughal has recently discovered in Punjab, some even near Harappa, and also those S.R. Dar of Lahore Museum has found near the Salt Range in Pakistan. We, therefore, argue that the Sarasvatī should also find a prominent place in the nomenclature of this civilization. Hence, in place of the old ones this new name, the Indus-Sarasvatī, which in any case still retains the 'Indus', because well known sites, like Mohenjodaro and Harappa are located in the basins of the rivers of the Indus-system. The total number of Indus-Sarasvatī sites comes to around 1400 on the present showing.

One thing more. It is common knowledge that it was on the banks of the Sarasvatī, now also called 'Sarasuti' (identified with Ghaggar and a few of its tributaries), that the hymns of the Vedas, the oldest literary texts in India, were composed. Sarasvatī, therefore, played an extremely important role in the making of the most ancient phase of the Indian Civilization, called the Indus-Sarasvatī Culture-Complex, placed in the fourth and the third millennia BC.

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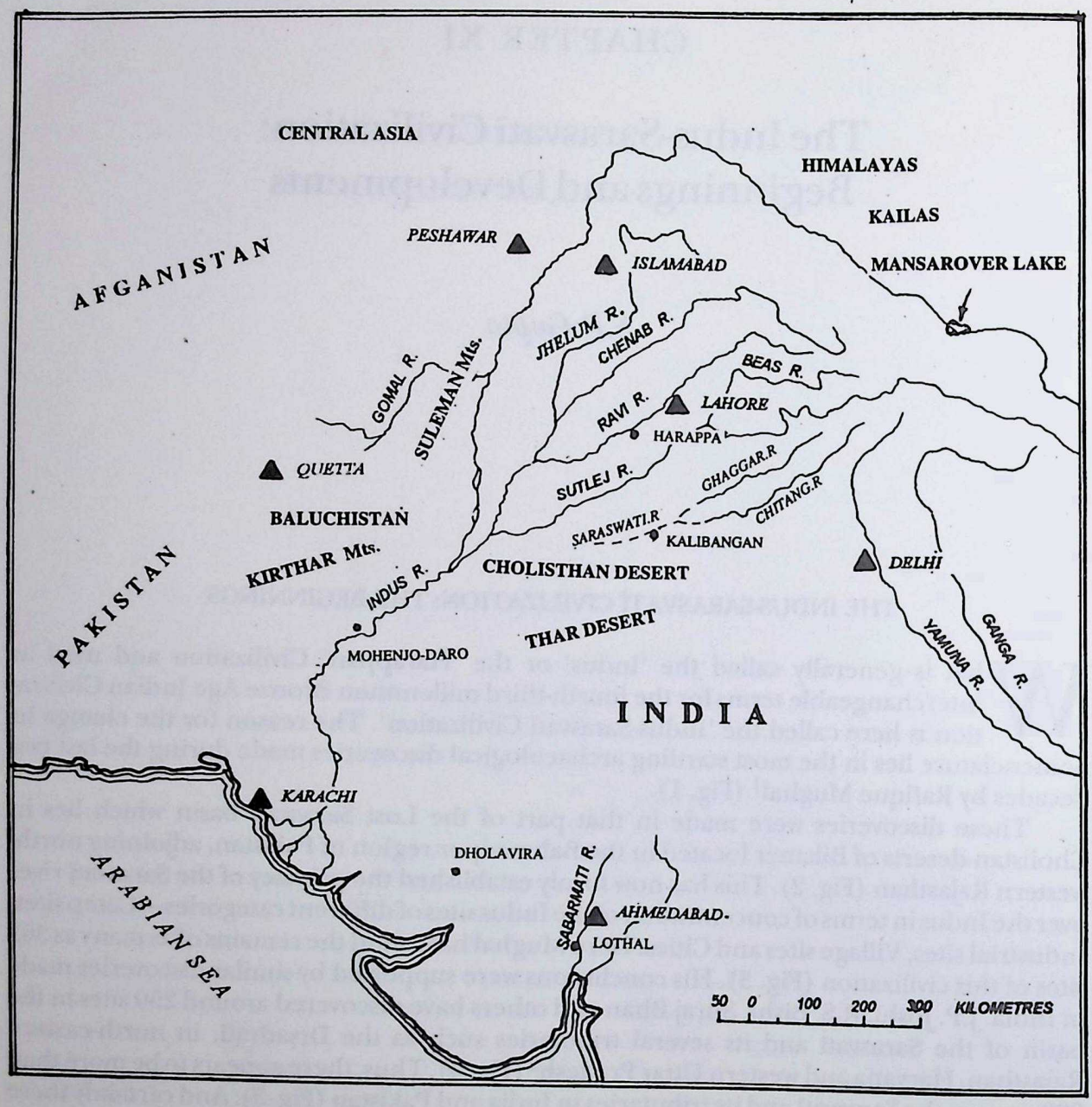

Fig.1: Map showing important rivers and mountains.

The Indus and the Sarasvatī together played the same role in the making of the Bronze Age Indian Civilization which the Tigris and Euphrates played in the making of the Mesopotamian Civilization during the same period of time.

Introduction

The Indus-Sarasvatī Civilization is found extending for more than 1600 km from north to south and equally from east to west, covering an area of about 2.5 million sq. km and more. The northern-most site known to us so far is Manda, located on the River Beas near Jammu; the southern-most site is Bhagatrav on the River Tapti in Gujarat; the eastern-most site is Bhorgarh in east Delhi and Alamgirpur in Distt. Meerut; and western-most site is Sutkagendor, located on the ancient shore of the Arabian Sea, near the eastern border of Iran. The Indus-Sarasvatī Civilization was, therefore, around four times more in area-coverage than any contemporary civilization, including Egyptian and Mesopotamian.

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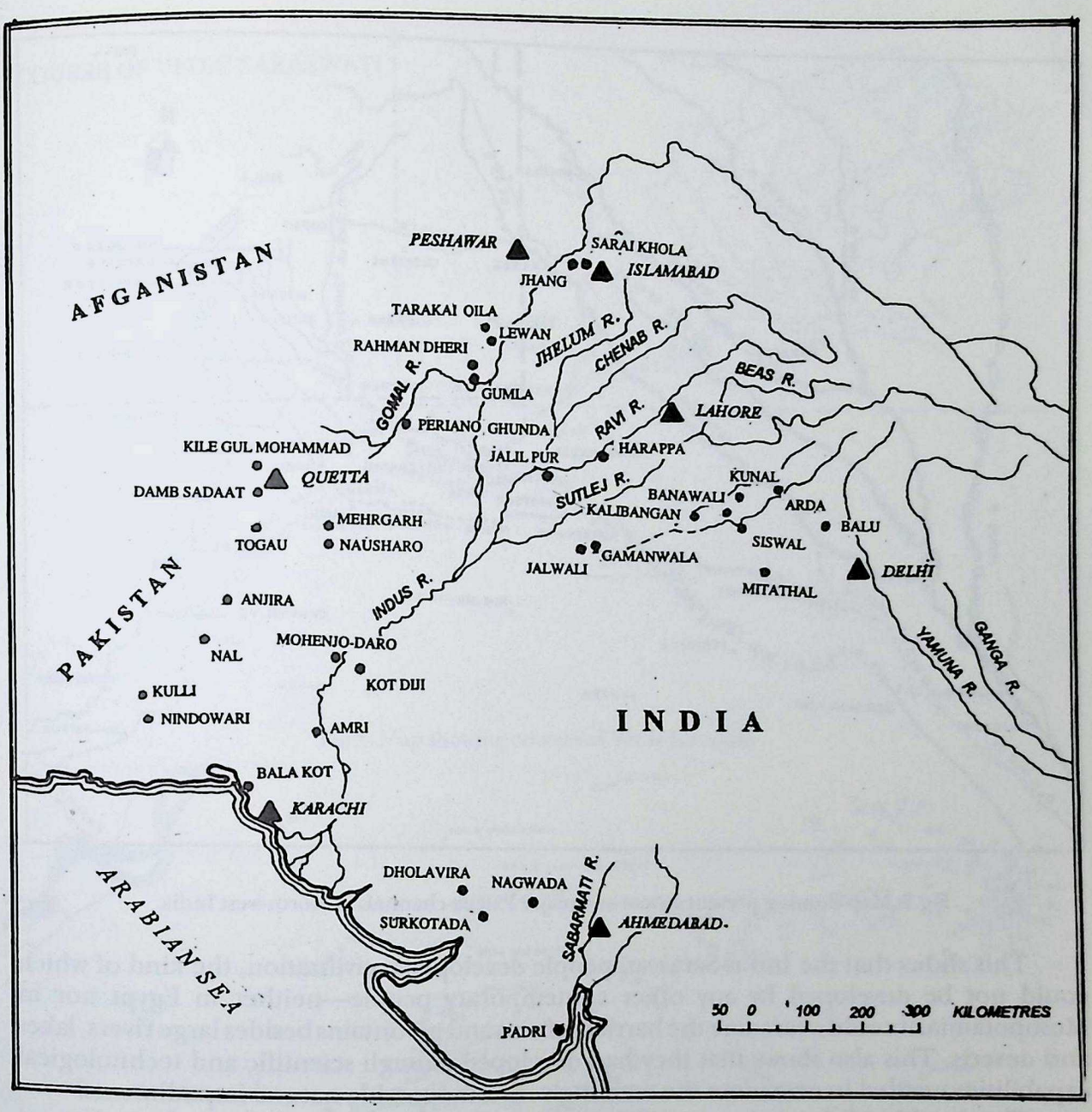

Fig.2: Map showing important Indus-Sarasvatī sites.

The sites belonging to the Indus-Sarasvatī Civilization are generally found located on rivers, either those still flowing like the Indus, or on the dried-up courses of old rivers like the Satluj, Sarasvatī and Dṛṣadvatī. There are some sites in the sub-mountainous regions as well, like Mehrgarh and Nausharo on the Bolan Pass of the Kirthar mountains overlooking the lower Kachhi plains, although here also the source of water lay in a river, the Bolan. In Gujarat, on the other hand, the sites are located either on the rocky surfaces with seasonal rivers flowing nearby, like Dholavira on the Manhar in Kacch, or else on the banks of small rivers which joined sea with the hinterland, like Bhogao on which Lothal was located. In Sindh, some sites, like Ghazi Shah, are found on lakes as well, like Lake Manchhar. In recent years some sites have been found on the ancient sea-coast as well, such as Bala Kot, Miri Kalat and Sotka Khoh, in Pakistan, and Somnath, Bet Dwarka, etc. in India, all on the Arabian Sea. Even the islands were inhabited such as the Khadir in the Rann of Kacch where sites like Dholavira were established.

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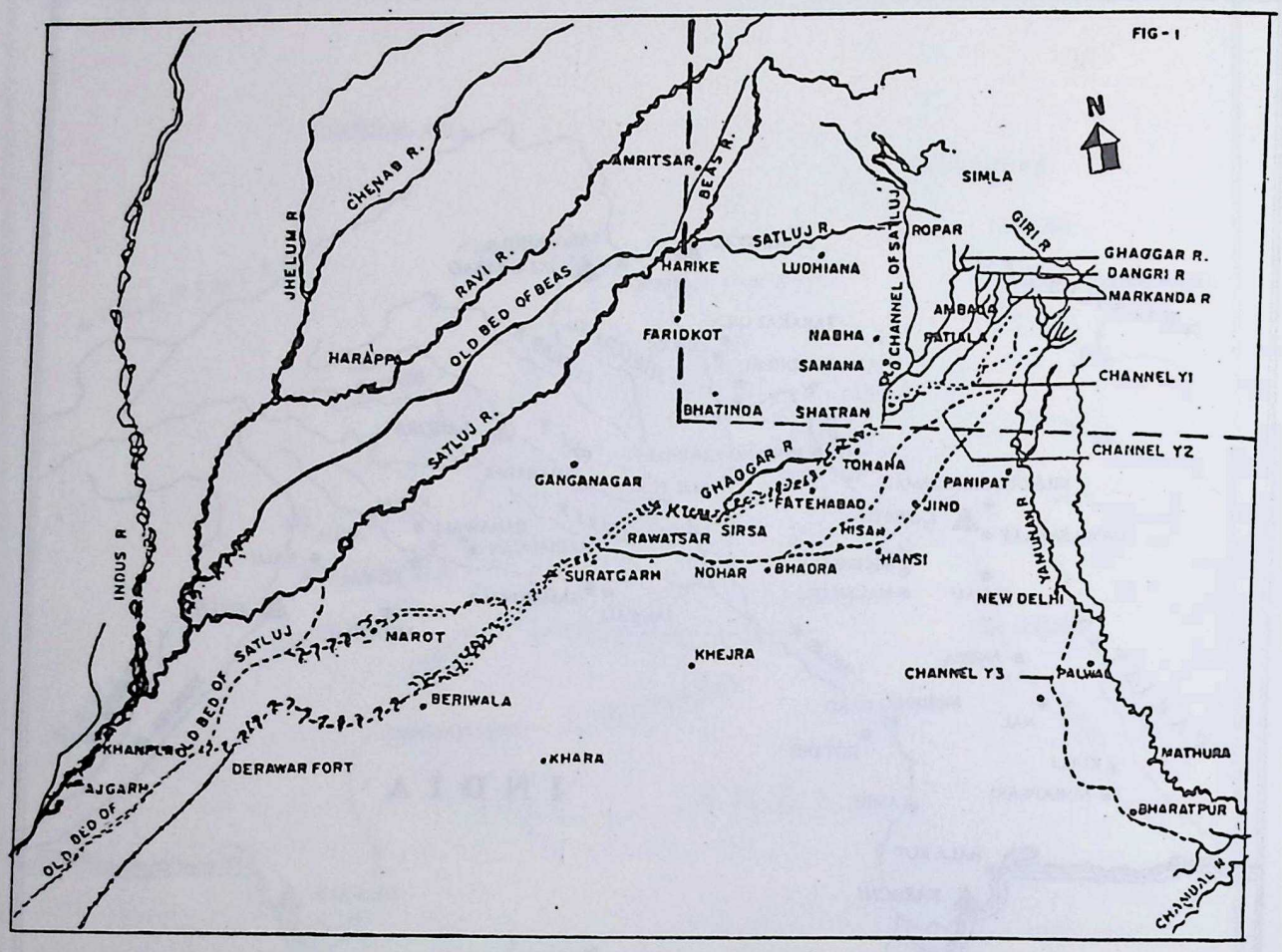

Fig.3: Map showing present system and major Palaeo-channels in North-west India.

This shows that the Indus-Sarasvatī people developed a civilization, the kind of which could not be developed by any other contemporary people—neither in Egypt nor in Mesopotamia; it could overcome the barriers of seas and mountains besides large rivers, lakes and deserts. This also shows that they had developed enough scientific and technological capabilities needed to overcome the seemingly insurmountable natural impediments.

The sites like Mohenjodaro and Harappa, located on the large rivers like the Indus and the Ravi respectively, were always threatened by floods, sometimes so severe that the people had to erect high mud and mud-brick platforms to build the houses on top of them for safety as Mohenjodaro and Chanhudaro. These cities suffered losses of men and materials several times during their existence. Kalibangan suffered similar losses due to earthquake and Kot Diji, Gumla, etc., due to fire. Thus, the Indus-Sarasvatī people kept on learning and improving skills in the field of town-planning and house-building, particularly in those areas of Rajasthan, Sindh and Punjab which were under the constant danger of being flooded.

Contrary to the popular understanding that all cities of the Indus were looked alike, no two Indus-Sarasvatī cities are found identical in town-planning, house-building and water-management system even though most of the sites are found protected by huge fortification walls and sharing common formal elements such as the division of the settlement in two (or more) unequal parts, the smaller of the two represented the so-called 'citadel', or the quarters of the political authorities, while the larger one represented the 'township', meant for the rest of the people as at Harappa, Mohenjodaro and Kalibangan. Interestingly enough, according

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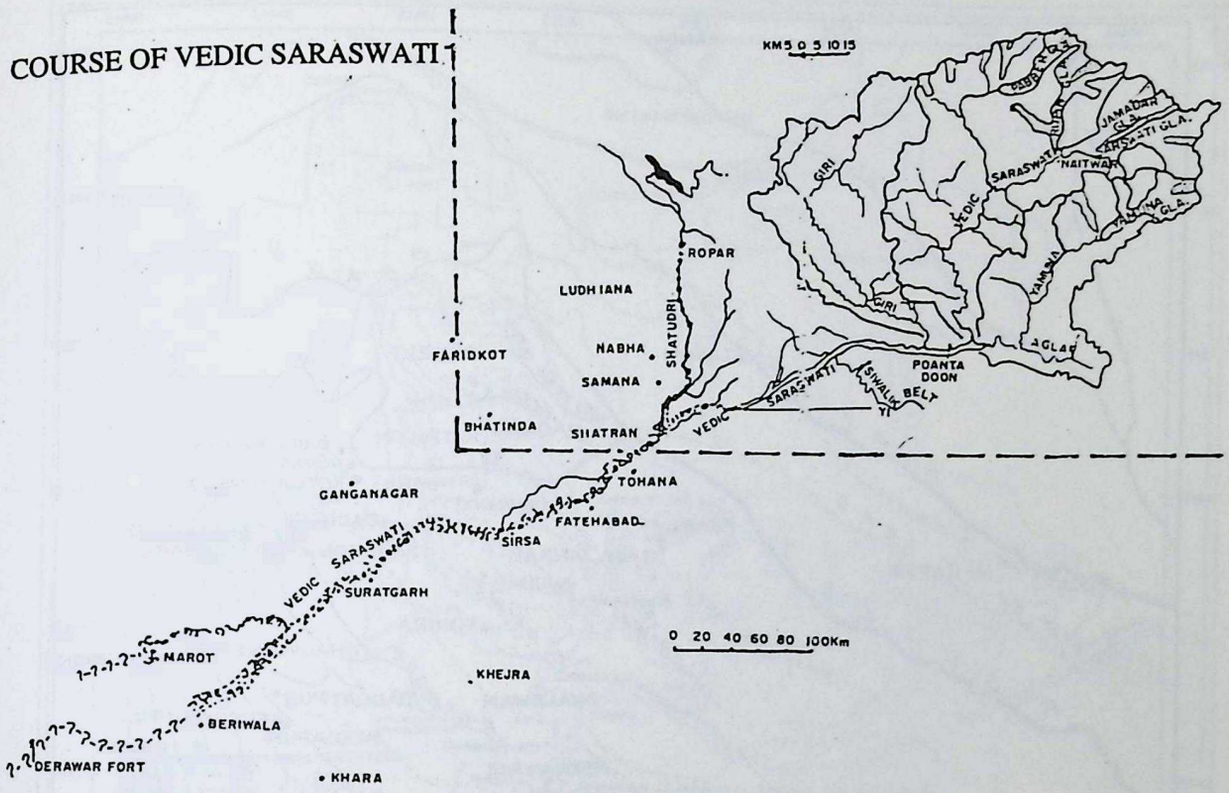

Fig.4: Map showing courses of Vedic Sarasvatī.

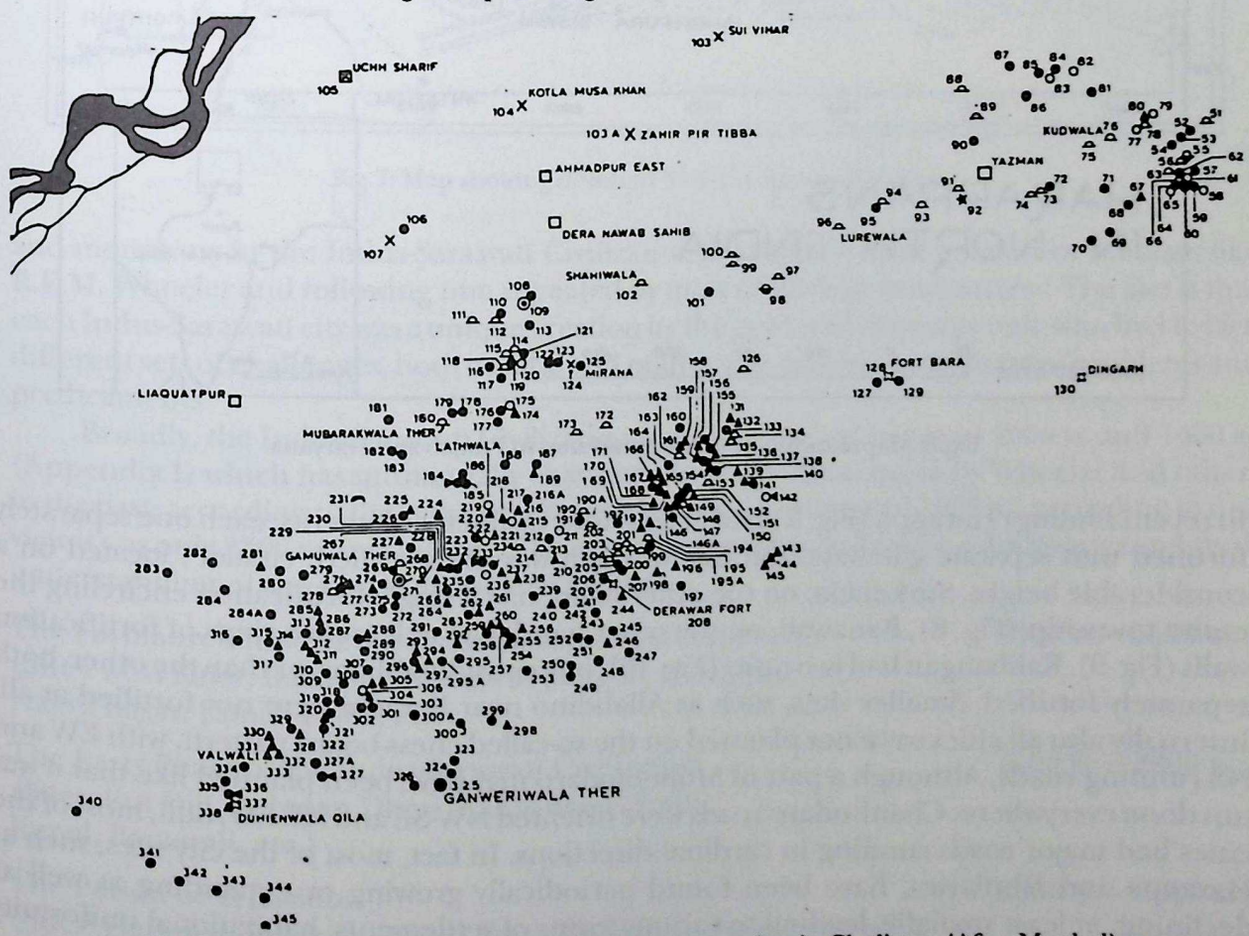

Fig.5: Map showing concentration of Indus-Sarasvatī sites in Cholistan (After Mughal).

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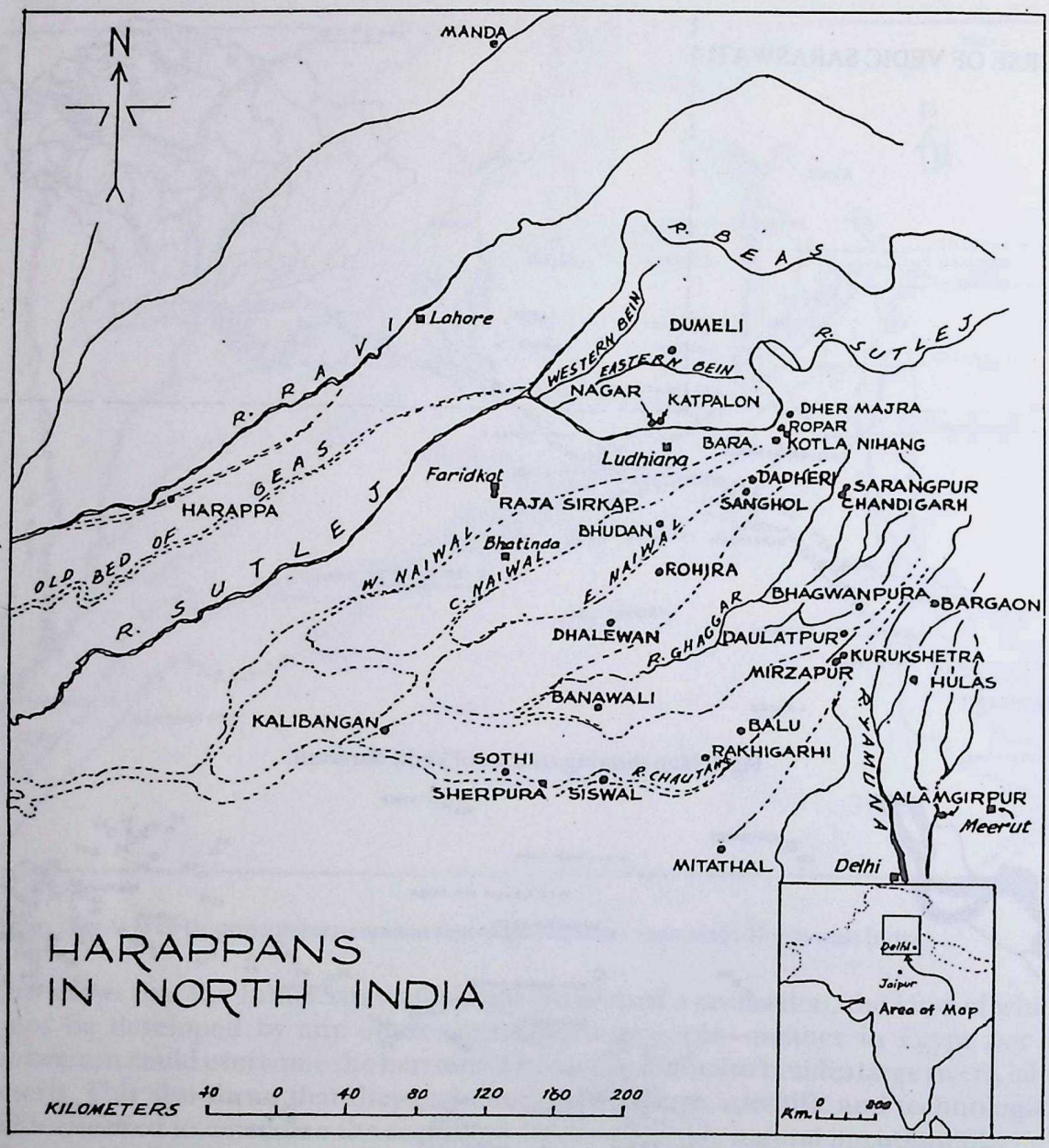

Fig.6: Map showing Indus-Sarasvatī sites in Punjab and Haryana.

to recent findings Harappa (Fig. 7) had at least four distinct settlements, each one separately fortified with separate gateways, but one of them was the so-called 'citadel', located on a considerable height. Surkotada, on the other hand, had a single fortification encircling the entire township (Fig. 8). Banawali, on the other hand, had at least two rings of fortification walls (Fig. 9). Kalibangan had two units (Fig. 10), one considerably larger than the other, both separately fortified. Smaller sites, such as Allahdino near Karachi were not fortified at all. Internally also all cities were not planned on the so-called chess-board pattern, with EW and NS running roads. Although a part of Mohenjodaro may have been planned like that it was not done everywhere; Chanhudaro roads were oriented NW-SE and NE-SW. Still, most of the cities had major roads running in cardinal directions. In fact, most of the city sites, such as Harappa and Dholavira, have been found periodically growing or expanding as well as declining, at least spatially, leading to various forms of settlements: habitational uniformity

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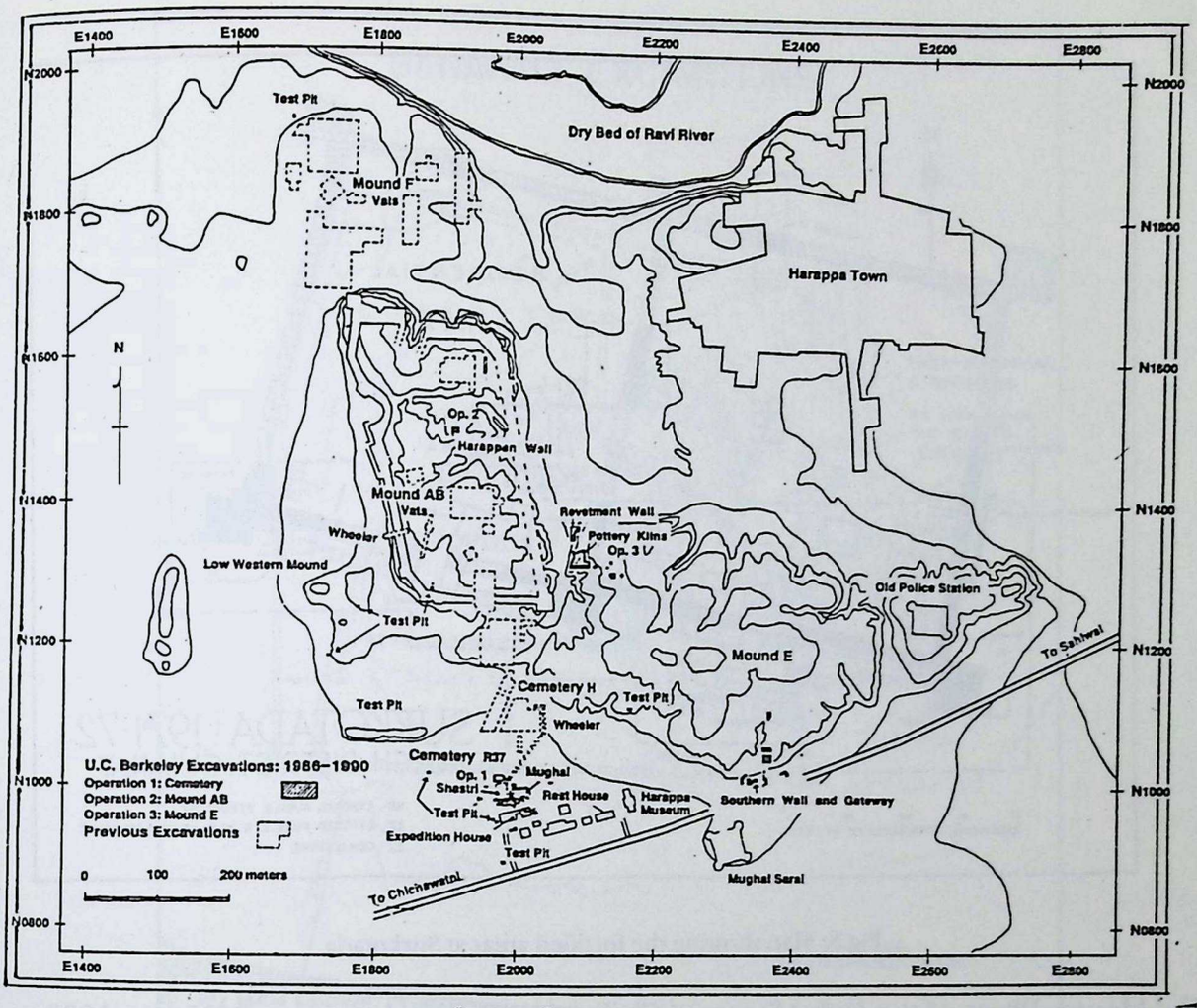

Fig.7: Map showing different fortified areas at Harappa.

and monotony in the Indus-Sarasvatī Civilization is indeed a myth created by scholars like R.E.M. Wheeler and following him repeated by most of the text-book writers. The fact is that each Indus-Sarasvatī city was a unique creation by the genius of its own people who had to face different sets of challenges, both natural and man-made, and not a single set of problems and predicaments.

Broadly, the Indus-Sarasvatī Civilization is now bracketed between 4000 BC and 1400 BC (Appendix I) which has substantially changed the proposition made by Wheeler and others in the past; according to them the bracket was between 2500 BC and 1500 BC, according to one view it was only 2300 BC and 1700 BC. The new chronology based on new discoveries and fresh understanding of the past is divisible as follows:

The Formative Phase of the Indus-Sarasvatī Civilization (Sites: Miri Kalat, Balakot, Mehrgarh, Jalilpur, Harappa, Hakra Basin, Kunal, Padri, etc.)	4000 BC – 3500 BC
The Early Phase of the Indus-Sarasvatī Civilization (Sites: Kot Diji, Rehman Dheri, Kalibangan, Sothi, Kunal, Banawali, etc.)	3500 BC – 2800 BC
The Period of Transition (Sites: Harappa, Rehman Dheri, Amri, Dholavira, Surkotada, etc.)	2800 BC – 2600 BC

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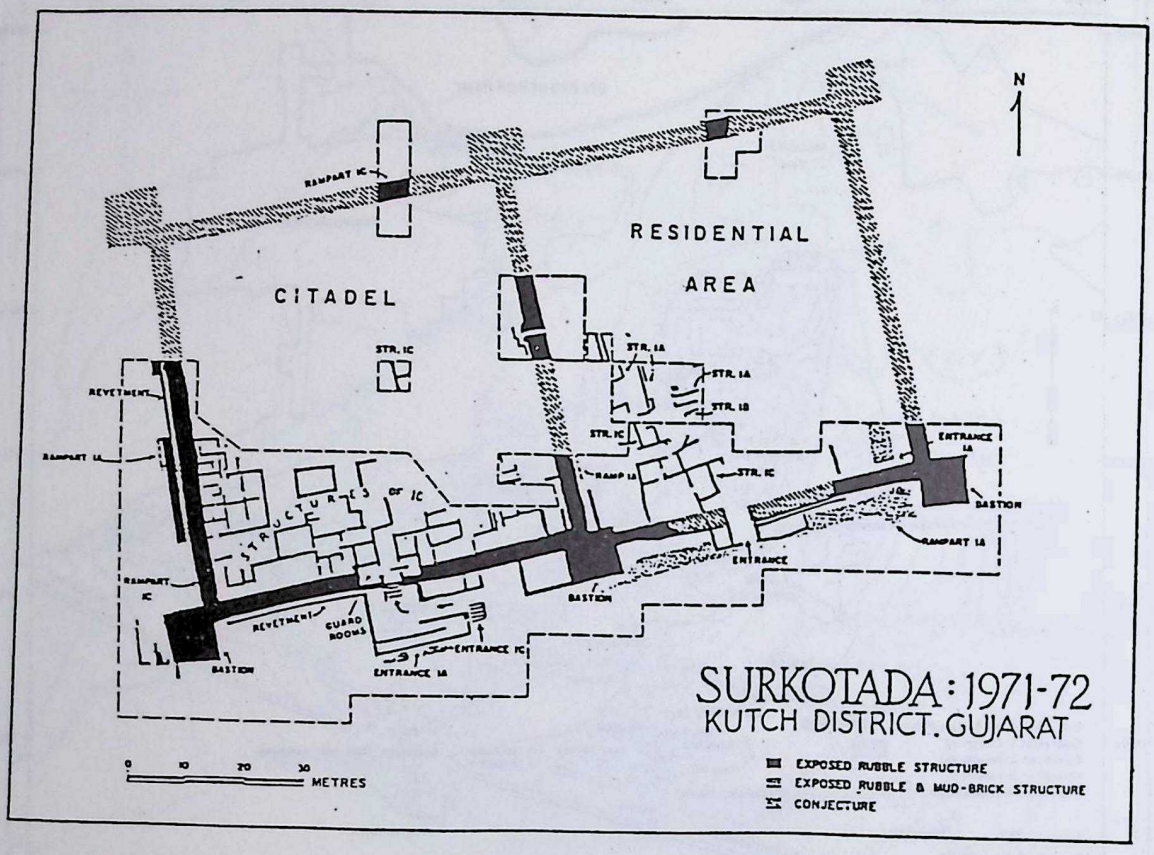

Fig.8: Map showing the fortified areas at Surkotada.

The Mature Phase of the Indus-Sarasvatī Civilization (Sites: Harappa, Mohenjodaro, Lothal, Kalibangan, etc.)	2600 BC – 1900 BC
The Late Phase of the Indus-Sarasvatī Civilization (Sites: Cemetery 'H' at Harappa, Jhukar, Hakra Basin sites, Yamuna Basin sites, etc.)	1900 BC – 1500 BC
The Final Phase of the Indus-Sarasvatī Civilization (Sites: Bhagwanpura, Dadheri, Dholavira, etc.)	1500 BC. – 1400 BC

(These are only broad chronological brackets of different stages of the beginning and the end of the Indus-Sarasvatī Civilization and are based upon calibrated Radiocarbon dates; see Appendix II)

The land covered by the people of the Indus-Sarasvatī Civilization is generally semi-arid although it encompasses a variety of regions—from the dry and cold hilly tracts of the Kirthar and the Suleiman in the north-west to the dry and arid zones of Sindh and Rajasthan in the south and the east, respectively. The climate in the third millennium BC was in all probability the same as now; except perhaps for a very short period of slightly higher precipitation, a theory not accepted by all. But local hydrological changes did occur in certain regions which affected the course as well as the volume of water in some perennial rivers. For example, during prehistoric times tectonic upheavals in the sub-Himalayan zone as well as Haryana and Rajasthan made the Sarasvatī shift its course several times, even divided its channel into more than one, all behaving like *wadis* (seasonal streams) and tributaries. One of the latest in the series created the Ghaggar-Hakra channel, called 'Sarasvatī Channel', between 10,000 and

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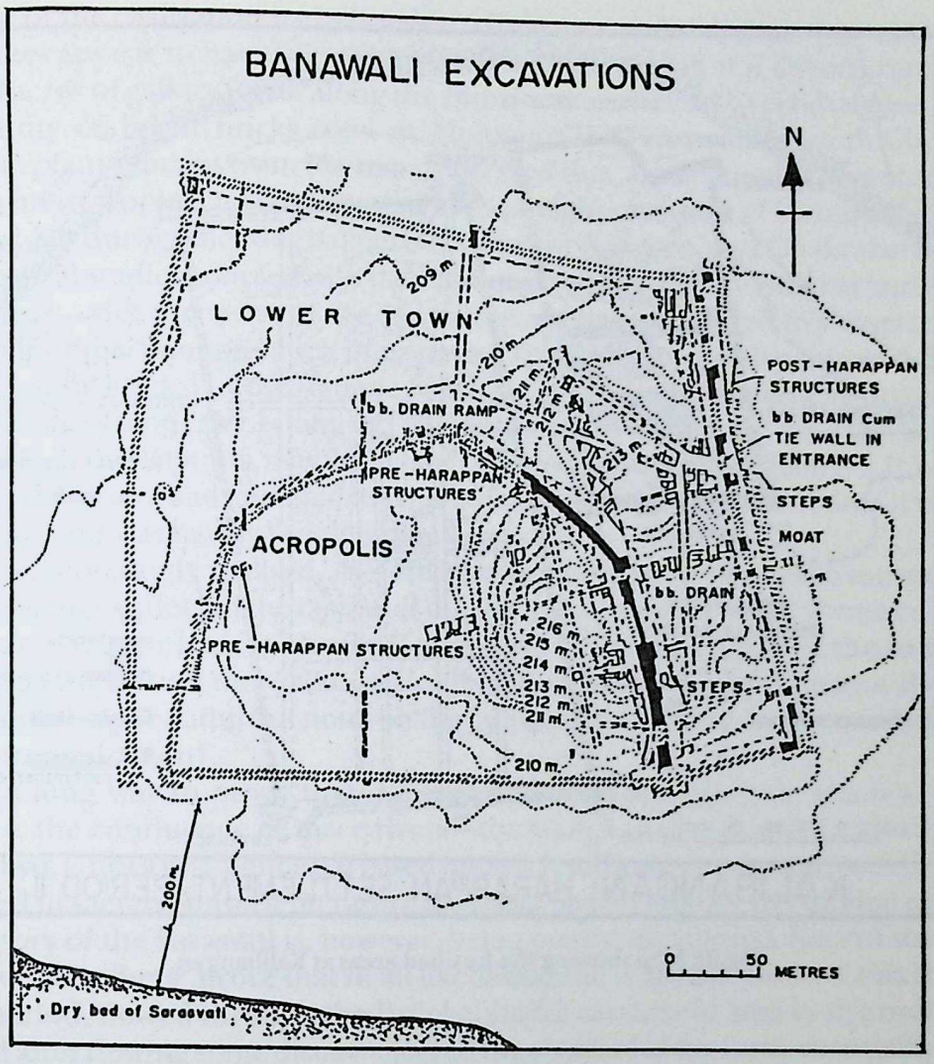

Fig.9: Map showing the fortified areas at Banawali.

5000 BC, after which aridity had set in which is not yet over. It was fed by the glacier 200 km north of Adi Badri. Around 2000-1900 BC a shift took place due to which the Ghaggar-Hakra-Sarasvatī water merged itself in the Yamuna through the Dṛṣadvatī Channel. On the other hand, the Satluj, a tributary of the Ghaggar-Sarasvatī channel shifted itself drastically north-westward and merged its water in the Beas.[3] All this because of the neo-tectonics in Haryana-Rajasthan. While this event of nature made the Ghaggar-Hakra-Sarasvatī channel cry for more water, the same event as well as neo-tectonic upheaval that occurred during the same time in southern Sindh, including the Karachi region, brought about unprecedented floods in the Indus as has been recorded at sites like Sehwan, Chanhudaro, Mohenjodaro, etc. (Fig. 11).

In the past, scholars like Marshall and Wheeler[4] had surmised that the climate in Rajasthan, Sindh and Punjab, the epicenter of this civilization, according to their views, was considerably wet throughout the 'Indus Period' because the seals as well as terracotta, stone and bronze objects show the presence of rhinoceros, tiger, buffalo, crocodile, etc. which live in water or slush of the marshy lands. They had also argued in favour of their theory on the basis of the presence of millions of burnt bricks at Mohenjodaro and Harappa which, according to them, must have required ample number of trees to be felled and burnt for fuel in the kilns. However, scientific studies hardly support this theory even though some feel on the basis of pollen studies conducted by Gurdip Singh at Sambhar and other lakes, that the

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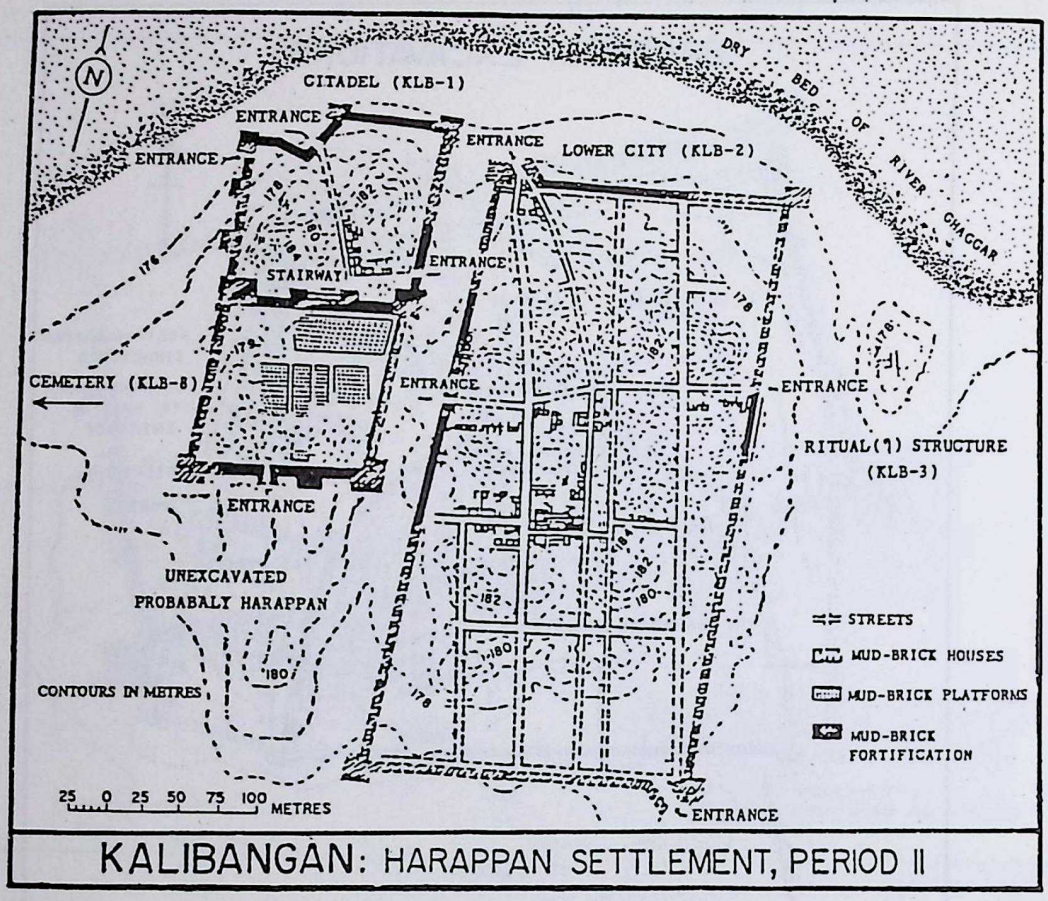

Fig.10: Map showing the fortified areas at Kalibangan.

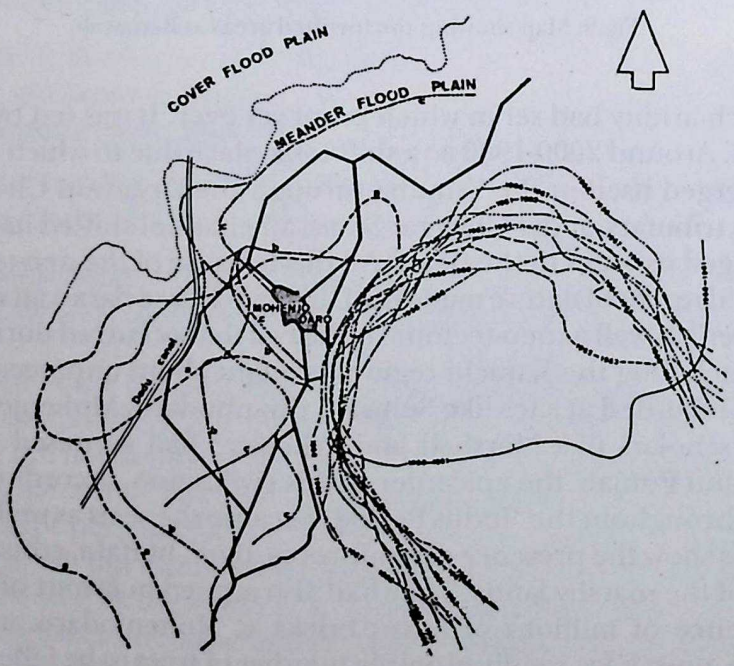

Fig. 11: Map showing the shifting of Indus-bed during the last 7000 Years.

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Mature Phase of the civilization had witnessed a little more rainfall than that of this day. But Rajasthani lakes appear to have dried from 5000 BC itself. Raikes and Dyson[5] rightly believe that only 400 acres of gallery forest along the Indus were sufficient to produce enough wood for the quantity of burnt bricks used at Mohenjodaro. Chowdhury and Ghosh,[6] after examining the plant remains from Harappa, observed that 'these remains do not support the theory that a moist tropical forest prevailed in the neighbourhood of Harappa.' 'Rhino was present in Punjab during the Mughal period,' observe Banerjee and Chakrabarti.[7]

Hydrological studies coupled with landsat imagery as studied by Yash Pal and others also show that at least twice the water of the Sarasvatī may have got completely diverted into the paleo-channels of the Yamuna which once passed through eastern Haryana and Bharatpur. Landsat imagery produced by the Remote Sensing Centre, Jodhpur, has also proved that the ancient Dṛṣadvatī or modern Chitang or Chautang was at one point of time the Yamuna; the present course of the Yamuna may have been created only around 2000 BC. It is common knowledge that Yamuna had changed its course drastically; at one point of time it was flowing near Bharatpur and was hardly touching Mathura.

It is now increasingly realised, as noted above, that the neo-tectonic movements and hydrological changes affected the course of the river Satluj as well—what was once a tributary of the Sarasvatī-Ghaggar had, at one time, after 1900 BC, became a part of the Indus system. Mughal has recently found more than a dozen Mature Indus-Sarasvatī sites on the old, now dried up, channel of the Satluj but none on the banks of the present-day channel of the Satluj (personal communication).

It goes a long way to prove that the oral tradition, according to which at Prayag or Allahabad it is the confluence of three rivers—the Gaṅgā, Yamunā and Sarasvatī—and not only the first two, is not a myth since it is based upon scientifically supported facts; the Sarasvatī is in fact called in sacred Sanskrit literature as *vilupta nadī* or completely hidden or lost river.

The history of the Sarasvatī is, however, being constantly studied. Recent studies made by Ghose, Kar and others[9] prove that in all likelihood the original course of this river, of the prehistoric period, flowed through the Pañchabhadrā catchment area in the north-western Aravallis, and after flowing some distance joined the channel of the Luni, eventually emptying itself in the Great Rann of Kacch. However, due to neo-tectonic movements its course shifted in north-westerly direction, first through the Jaisalmer region and, after some time, through the present-day Ghaggar-Hakra-Sarasvatī channel. But at what point of time the Sarasvatī left the Luni channel and adopted the present-day Ghaggar-Hakra channel in the Bikaner region is yet to be worked out, but one thing is absolutely clear: during the fourth millennium it flowed past Banawali, Kunal, Kalibangan and entered the Bikaner-Bahawalpur region of Pakistan. In other words, the Luni and Jaisalmer stages of the Sarasvatī were of the Stone Age Period while the Ghaggar-Hakra stage is of the Bronze Age.

THE INDUS-SARASVATĪ CIVILIZATION: THE FORMATIVE PERIOD

It is commonly believed that the Indus-Sarasvatī Civilization was the product of the Indus river; the hill of Baluchistan had hardly any significant role to play in its formation. But after the excavations conducted at Mehrgarh, our entire perspective of the hill cultures of Baluchistan, hence about some vital aspects of the beginning of the Indus-Sarasvatī Civilization, has undergone a sea-change. No one any longer looks at Baluchistan either in terms of a 'corridor' through which Iranian and Turanian cultures passed on their way to the Indus Valley and caused the Indus-Sarasvatī Civilization, or in terms of a rugged mountainous region with 'as many cultures as there are hills'. Instead, everyone now sees the hills and sub-mountainous regions of Baluchistan as the 'nuclear zone' which gave birth to a very long succession of

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cultures, starting from the Aceramic Neolithic, datable to the eighth millennium BC to the beginning of the Indus-Sarasvatī Civilization, in the fourth millennium BC. In other words, what was once thought by Piggott, Wheeler and others to be a loose chain of autonomous Neolithic and Chalcolithic cultures, inspired or produced by Iranian cultures of the fourth and third millennia BC, can now be seen as parts of well-integrated cultural systems operating on an inter-regional basis all along the sub-mountainous regions, skirted by the Kirthar and Suleiman mountains and the basins of the Indus, Ravi, Chenab, Satluj and the Sarasvatī, along with their tributaries. It is this system, which eventually gave birth to the Indus-Sarasvatī Civilization in the plains of the Indus and the Sarasvatī, through a long process of economic and cultural interactions between the hill people and the plains people. (Fig. 12)

Scholars engaged in the study of Central Asian archaeology have also shown that the cultures which were, till recently, thought to be the products of southern Turkmenistan Chalcolithic cultures in Baluchistan, such as the Namazga Period III culture, giving birth to north Baluchistan Chalcolithic cultures, of say Periano Ghundai and Gumla, are no more understood exclusively in these terms; in fact, the reverse may have been the case—Baluchistan may have been at the root of the Namazga-III cultures. For example, Sarezm, a late fourth millennium BC site near Samarkand in Uzbekistan, has yielded a number of 'Tagau A' style potsherds emanating from Baluchistan (Fig. 13). In the earliest levels of Mundigak in southern Afghanistan, datable to 3500 BC, also one can see many Baluchi potsherds. Even in the third millennium levels of Sarezm (Pd. III and IV) where Quetta pottery predominated. In the Taluqan region of southern Bactria, located in northern Afghanistan, in the Oxus basin, a dozen sites have yielded Baluchi pottery[10] and not Central Asian pottery of Namazga origin.

This evidence clearly shows that, in the fourth and third millennia BC, the cultures of Baluchistan were predominant in Afghanistan, parts of Turan, Uzbekistan and Turkmenistan. However, in the early second millennium BC, when the Early Bronze Age Indian Civilization started collapsing, Chalcolithic culture, which arose locally in Bactria, one of them called 'Dashly III', with its exclusive range of light red potteries with channel spouted bowls and chalises on stands, did reach Bolan sites like Nausharo. These people established a regular village and lived and died there for a few centuries with their characteristic potteries.

Wheeler, therefore, may have erred grossly when he observed, in the context of the birth of the Indus-Sarasvatī Civilization, that 'the stimuli are presumed to have arrived from the West'. In fact, the stimuli was here, within the Indian borderlands, in the piedmont region of Baluchistan, 'the west' meaning Mesopotamia for Wheeler, Iran for Gordon and Piggott and Turan for Tosi, had hardly anything to do with it. There is now no doubt that the Indus-Sarasvatī Civilization developed locally in India and then spread in the mid third millennium beyond her frontiers towards the west and the north-west, across Baluchistan and the Hindu Kush. The presence of the Indus-Sarasvatī site of Shortughai, and a dozen more, in the Kokcha Valley of northern Afghanistan, proves it amply. The discovery of Indus-Sarasvatī seals at Altin Depe in south Turkmenia and Shortughai in Oxus basin also indicates the same. The Persian Gulf sites have produced a host of Indus-Sarasvatī objects, including seals, in Oman and Bahrain, respectively at sites like Ras-al-Junyaz and Hammad to establish further this very fact.

India was indeed never an island, completely cut off from the neighbouring countries, in the pre-Indus-Sarasvatī times too, effective contacts did exist between India, Iran and Central Asia, but this is not the same thing as saying, as Piggott, Wheeler, Flam and others do, that the Indus-Sarasvatī Civilization was the gift of Mesopotamia to India. Some scholars, like G.L. Poesshl (personal communication), still believe that the Neolithic culture of Mehrgarh came from West Asia, in the Zagros mountains, where it had an earlier and humbler beginning, forgetting the fact that there is nothing very specific in the earliest levels of Mehrgarh which was Irani or Iraqi Neolithic as such. Observations like 'more primitive'

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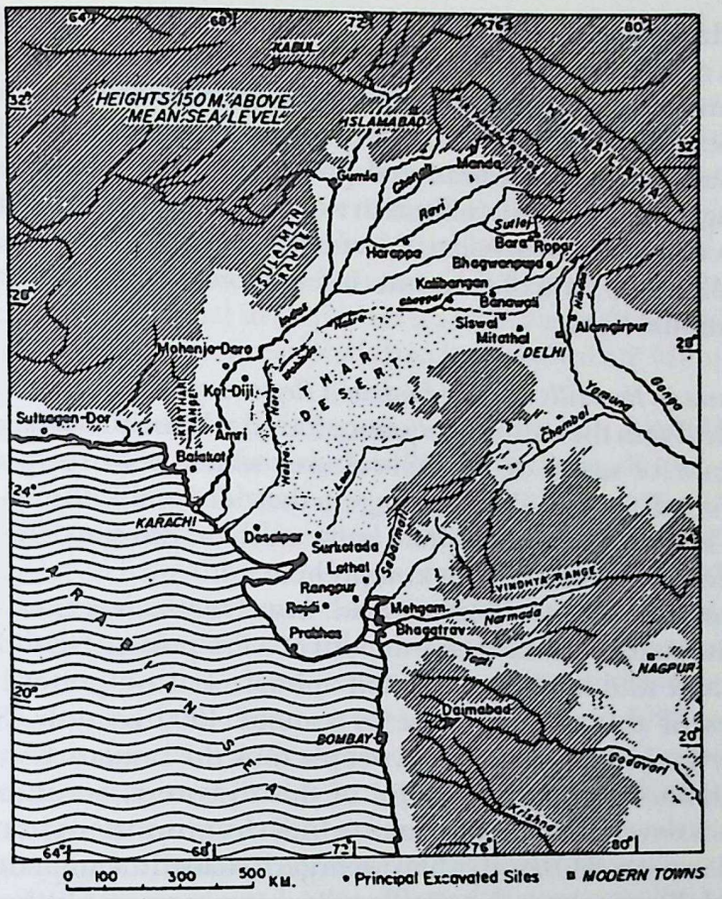

Fig.12: Map showing the Physical features of Indus-Sarasvatī sites.

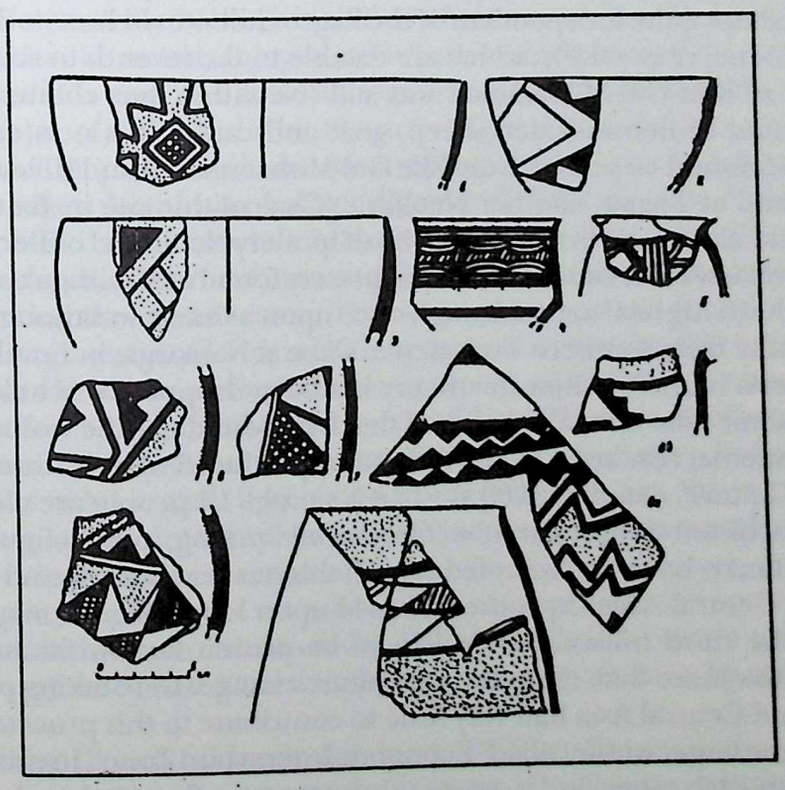

Fig.13: Painted Pottery from Sarezm, Uzbekistan, 4th mill.

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Neolithic than Mehrgarh are hardly sufficient to locate the ancestry of Mehrgarh in the 'more primitive' site; it is not a sound argument since in Baluchistan Kile Gul-Mohammad (earliest levels) was also 'more primitive' than Mehrgarh. Our position, as borne out by recent archaeological researches, is clear: the Indus-Sarasvatī Civilization was a unique product of a slowly growing and changing civilizational process that was occurring from the eighth millennium through the third millennium in north-western India, including the Indus and Sarasvatī basins, in which the West Asian, Turanian and Central Asian cultures had some role to play but generally in the field of economic interaction and not so much in social, cultural, religious and ideational fields.

The Neolithic Cultures in the Hills and the Piedmont Regions of Baluchistan

We will now deal with the cultural-sequence found at Kile Gul-Mohammad and Mehrgarh since this takes care of many of the hill-cultures which were so long considered to be individualistic. We, of course, do not suggest that all local cultures of Baluchistan are represented here but we do maintain that, between these two sites, the major stages of pre-Indus-Sarasvatī Civilization can be fully comprehended.

Kile Gul-Mohammad: Kile Gul-Mohammad, near Quetta, was excavated in the 1950s by Fairservis.[11] The site yielded a four metre deposit of a Pre-pottery Neolithic Culture, with the remains of huts, and wild and domesticated animals, but no pottery. Unfortunately, the radiocarbon dates of this deposit came to around 4000 BC only. Since calibration of radiocarbon dates was unknown then and people took the radiocarbon dates as calendrical dates, it made scholars slightly unmindful of this discovery, because it only meant that 'Neolithism' did not develop locally but came to India from northern Iran where it had started in the seventh millennium. However, when Mehrgarh yielded a similar deposit with corrected radiocarbon dates falling in the early seventh millennium, or even a little earlier, in the eighth, scholars' attention was drawn to it because it then became quite clear that agriculture and domestication of animals, the two major characteristic features of Neolithism, developed in Baluchistan perhaps quite independent of the Zagros hill sites in Iran and Turkmenian sites, such as Jeitun Depe, respectively, which are datable to the seventh to sixth millennium.

Period II at Kile Gul-Mohammad was still 'Neolithic' but characterized by painted pottery and bones of domesticated sheep, goat and cattle. It is now established that the geometric motifs found on pottery from Kile Gul-Mohammad II and III levels, and caprid and bird motifs found at Togau, another Neolithic/Chalcolithic site in Baluchistan, as also at Damb Sadaat, are also found in the early levels of 'pottery Neolithic' or Period II at Mehrgarh.

Almost similar was the situation with the pottery found at Mundigak, an equally early site located in southern Afghanistan, although once upon a time it was thought that the painted designs on it came from southern Turkmenia, since at Namazga, in Levels II and III, similar designs have been found but now the theory has been dropped by scholars.

For quite some time it was also believed that from Mundigak the 'colonists', coming from southern Turkmenia, reached Quetta Valley and produced what is normally called Quetta Painted Ware Culture, dated to 3000 BC. The Namazga III people are also credited to have brought in Baluchistan complex architecture, metal working, human figurines and compartmented seals. It may, however, be noted that all this has now been found at Mehrgarh itself.

Thus, the Central Asian hypothesis, based upon long-distance migrations during the beginning of the third millennium, taken to be proven fact so far has now completely collapsed. It is now more than clear that the culture changes were taking place in Baluchistan indigenously and Central Asia had very little to contribute to this process. The latter region formed part of the larger whole called 'Economic Interaction Zone', in which cultures coming into contact with each other due to economic interests, influenced each other only margin-

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ally. The evidence also shows that Baluchistan's influence on Central Asia during the fourth and early third millennia was also only marginal.

Once it is clear that sites like Mehrgarh were at the centre stage of most of the early (fifth-fourth millennia) Baluchi cultures and not the Iranian and Central Asian sites, we should now deal with the larger question of the beginning of farming and domestication of animals in north-west India because it has direct bearing on two still larger questions related to the history of India; these are the questions which have bothered both linguists and archaeologists in India and abroad for a very long time: the diffusion of Indo-European (language) and the Indo-Europeans (the Rgvedic Aryans) in India: was it a fact of world history? But before these are attempted, let us understand the directional changes in culture at Mehrgarh, our key site in India's borderland.

Mehrgarh: The earliest settlers of Mehrgarh,[12] a site in the foothills of Baluchistan, belonging to Period I, may have come from the late Stone Age nomadic people of Baluchistan itself who were using microliths for tools and open spaces for temporary settlements. This may easily be made out from the geographical location of Mehrgarh (Fig. 14) and the faunal bones and floral remains recovered from the lowest levels of the site (Period I)—these are generally of wild species. It may be clearly understood that it is not at all easy to locate the region or site from where these nomadic people came to settle down at Mehrgarh. There is a reason for this. No archaeologist had been able to work out precisely the routes of dispersal of the microlith-using nomadic people in Asia in the time-bracket of 10,000 BC and 7000 BC, only unsubstantiated guesses have been made. The settlements of the peoples of this period are found in Afghanistan as well as Iran at several places. In any case, very soon (Period II) these people made permanent mud houses and storage rooms, evolved methods to produce hand-made coarse pottery and attempted to domesticate some animals, such as cattle. It may also be noted that the animals and plants, domesticated during Period II, continued to be domesticated in all the following periods.

The studies made on animal bones show that domesticated fauna included sheep, goat and cattle and the domesticated cereals included wheat and barley. Kachhi plains, in which the site is located, it may be noted, enjoys a mild climate which favours the natural growth of nutritional crops both for men and animals; regions of extreme climates do not do so. This is very significant. A lot of water and a lot of sun in tropical areas favoured quick growth of vegetation. The Kachhi plains and the surrounding highlands, it may also be noted, complement each other, both morphologically and climatically; Kile Gul-Mohammad is located on 1500m MSL highland while Mehrgarh is located at only 150 m MSL height, keeping the population still seasonally moving from the highland to the lowland, when it is very cold and dry during the winter season. This social phenomenon played a very important role in integrating large tracts of land, including those ecologically different, into a system which works wonders because it brings various peoples, of different technological attainments, face to face and allows them to interact and learn from each others' experiences. Herein lies the genesis of the settled life in the plains of north-western India.

The first settlers at Mehrgarh (IA), dated to 8215-7215 BC, i.e., the late eighth millennium, depended for meat almost completely on wild animals; and for cereals also they largely depended on harvesting the wild varieties of barley, which were, however, gradually getting domesticated because year after year the seeds of the same species were sown and resown, to begin with, accidentally but later intentionally. This shows that they were primarily hunters and gatherers although they had started living in a sedentary fashion by establishing open villages.

In the succeeding IB and IIB levels, datable to 6000 BC, the site is found covered with clusters of mud-brick structures, some so regular in terms of juxtaposed rectangular chambers that archaeologists suspect that these may have been used for storage purposes. Such

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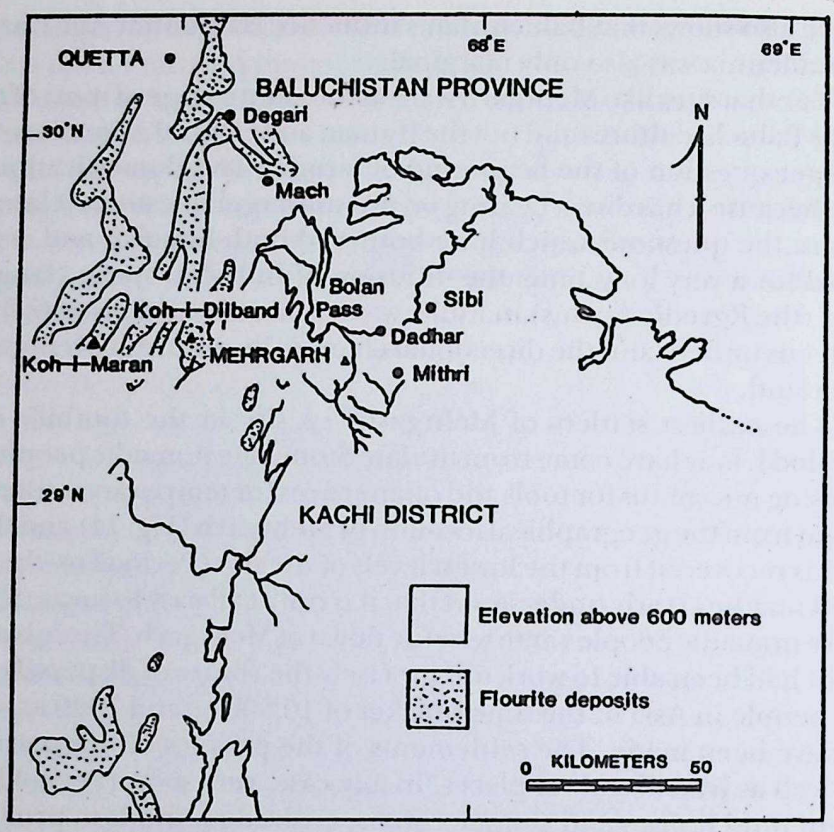

Fig.14: Map showing the location of Mehrgarh sites.

'granaries' served perhaps as centres for redistribution of cereals. These were built upto 4000 BC, i.e., upto Period III (Chalcolithic).

This cultural element presupposes the establishment of some kind of regulated corporate life. This need not surprise us because it is inherent in the very system of village life. The harvesting, it may be noted, was done by sickles, using stone blades mounted on wooden handles and fixed with natural bitumen, the remains of which have been found in the excavations. It indicates that the village was small, with population of not more than a 1000 people at any point of time, since this technology would normally not favour intensive agriculture, as Masson has been able to work out for Jeitun Depe in south Turkmenia.

Disposal of dead ceremoniously was also an important item in their life. In Neolithic times (Periods IA and IIB), the dead were buried within the habitation with grave-goods such as jewellery of semi-precious stones like lapis lazuli and turquoise, or sea-shells and animal bone, or a combination of these items. This shows, on the one hand, that the people had long-distance mobility, and, on the other, that they had evolved some concept of ownership over the objects of the dead who had used them in his or her lifetime. However, from Period IIA till period III, the grave-goods were almost non-existent, which may reflect change in their concept of life after death as well as the ownership rights of the dead over the objects which were under his or her possession while alive.

People also started making art objects. Clay figurines, for example of Zebu started appearing in the lowest levels of the Neolithic, but gradually, from 6000 BC onwards, even human figurines, carefully baked, became popular, just as pottery was.

It is significant to note that metallurgy evolved in the Neolithic period itself. Copper, in the form of a bead, was found in a Period IB level (6000 BC) inhumation burial but its developed technology and increased use is attested to only from later levels of Period III, datable to 5000 BC which have yielded several copper awls, hooks and blades. Obviously,

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technological innovations in metallurgy was a big step forward achieving efficiency in everyday life, hence accelerating the pace of development in every field of life, including agriculture. From now onwards people could move even in wooded areas along the rivers and settle there by clearing jungles and making long-lasting roofs over their huts.

It is now well established that around 4000 BC pottery in most of Baluchistan was remarkably homogenous even though regional peculiarities never ceased to exist. So much so that the distinction between 'Kile Gul-Mohammad' and 'Togau' styles of painting 'has now no justification' Kalat, Quetta, Zhob and Loralai potteries are also one with those found at Mehrgarh even though the sites which have yielded them are located in the highland. During the same period, villages, that is small permanent settlements, begin to appear on the banks of the Indus and its tributaries, such as the Ravi. Amri, excavated by Casal, for example, was one such village, though technically located in the hilly tract on a small river it was just near the Indus. It later evolved into a township through a long process of development. Here, the developed form of Kile Gul-Mohammad/Togau painted pottery, which is also present at Mehrgarh, was found in the lowest levels, a fact which clearly shows that the highlanders came down to the lowlands and established the first settlements in the river valleys around 4000 BC, may be around 3800 BC date falling in period IB, a level later than the earliest level at Amri.

The early fourth millennium (Chalcolithic period) is, therefore, the most crucial period in which large areas get integrated through trade, mainly by nomads; the hills of Baluchistan, plains of Gujarat and also the basins of the Indus and the Sarasvatī systems formed part of this large network. It became the 'Formative Period' of the Developed Urban Phase of the Indus-Sarasvatī Civilization of the third millennium since the roots of this civilization are found firmly established in the Neolithic and Chalcolithic village-cultures which had moved from the foothills of Baluchistan into the plains at Amri, Jalilpur, Harappa, and at several Hakra Culture sites in the Bahawalpur region of Pakistan. It saw the birth of even large settlements elsewhere too, beyond Baluchistan, for example at Shar-i-Sokhta, in Iranian Seistan, and at Mundigak in southern Afghanistan, where even protective walls or fortifications were erected around the habitation. As far as Mehrgarh is concerned, clusters of houses, concentrated in different areas of the settlement, large storage jars fixed in the ground, burial-grounds in the domestic area, etc. (Fig. 15) show the same directional changes, the birth of large villages with the advantage of improved methods of farming and irrigation: the flood-plain was cultivated with water brought from canals during the lean periods. The early fourth millennium BC Chalcolithic cultures of Gujarat also formed part of this process of change from village to city (Appendix III).

This ties up with the succeeding Kot Diji-Sothi culture-complex, variously called the 'Early Harappan' 'Early Indus' and 'Early Indus-Sarasvatī' Civilization. This is represented at Mehrgarh in Level VII-C and in the lower levels of Nausharo (Fig. 16). Now some villages grew into towns.

Nausharo: Near Mehrgarh is the site of Nausharo, only[13] six km away. Here we have the remains of the Mature Phase of the Indus-Sarasvatī Civilization. The site was, however, a settlement of the people of the Early Indus-Sarasvatī Civilization also, in lowest levels. In this sense its stratigraphy is similar to that of Kot-Diji: Early Indus-Sarasvatī succeeded by Mature Indus-Sarasvatī Civilization. Apparently, Mehrgarh was not found suitable for the establishment of a township during the Mature Phase of the Civilization, may be due to hydrological reasons, such as the occurrence of sudden floods and concomitant erosion of land. Hence, it was abandoned around 2800-2700 BC. Nausharo, where there was already a developed settlement of the Kot-Diji Culture, perhaps from 3000 BC or a little earlier, was favoured for this purpose by the people although here also a very large city could not emerge, even though the settlement was divided into blocks of mud-brick houses divided by roads and streets as at any typical planned Indus-Sarasvatī city, because of two factors: first, Dabar Kot, a site also in

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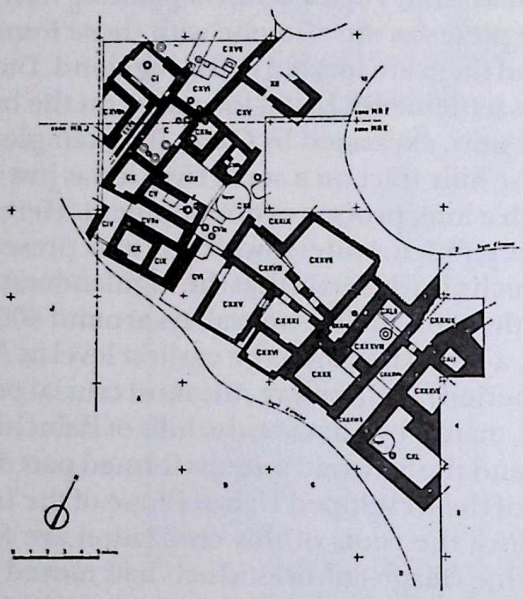
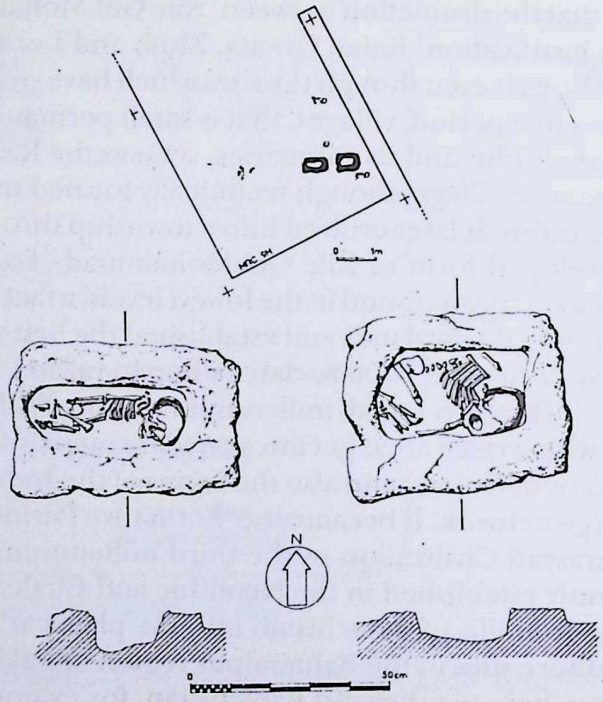
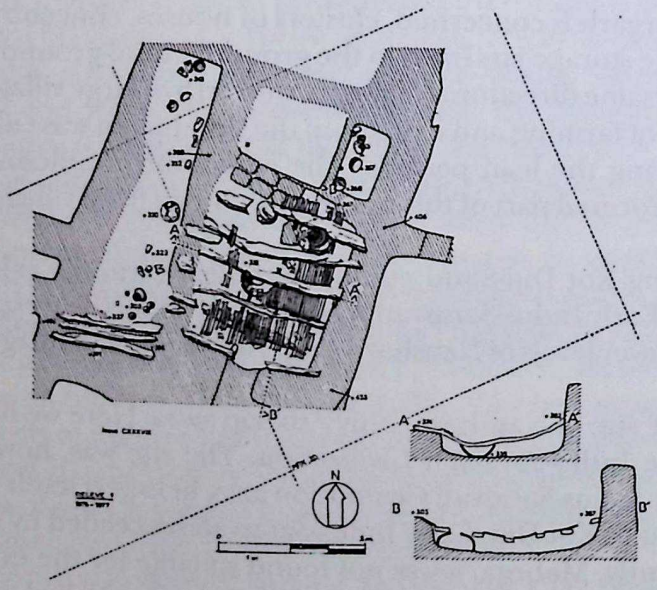


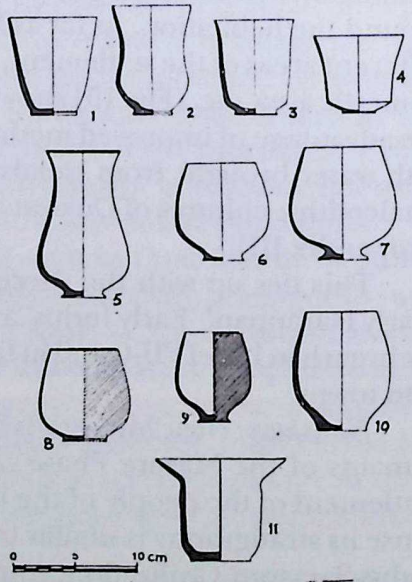
Main Mound. Plan of architectural remains in the upper layers of Period VII.



Plan of infant graves. Main Mound, Period VII.



Plan of locus CXXXVIII. Main Mound, Period VII.



Plain pottery from the Main Mound, Period VII

Fig.15: Map showing Houses, Burials, Potteries at Mehrgarh, Period VII.

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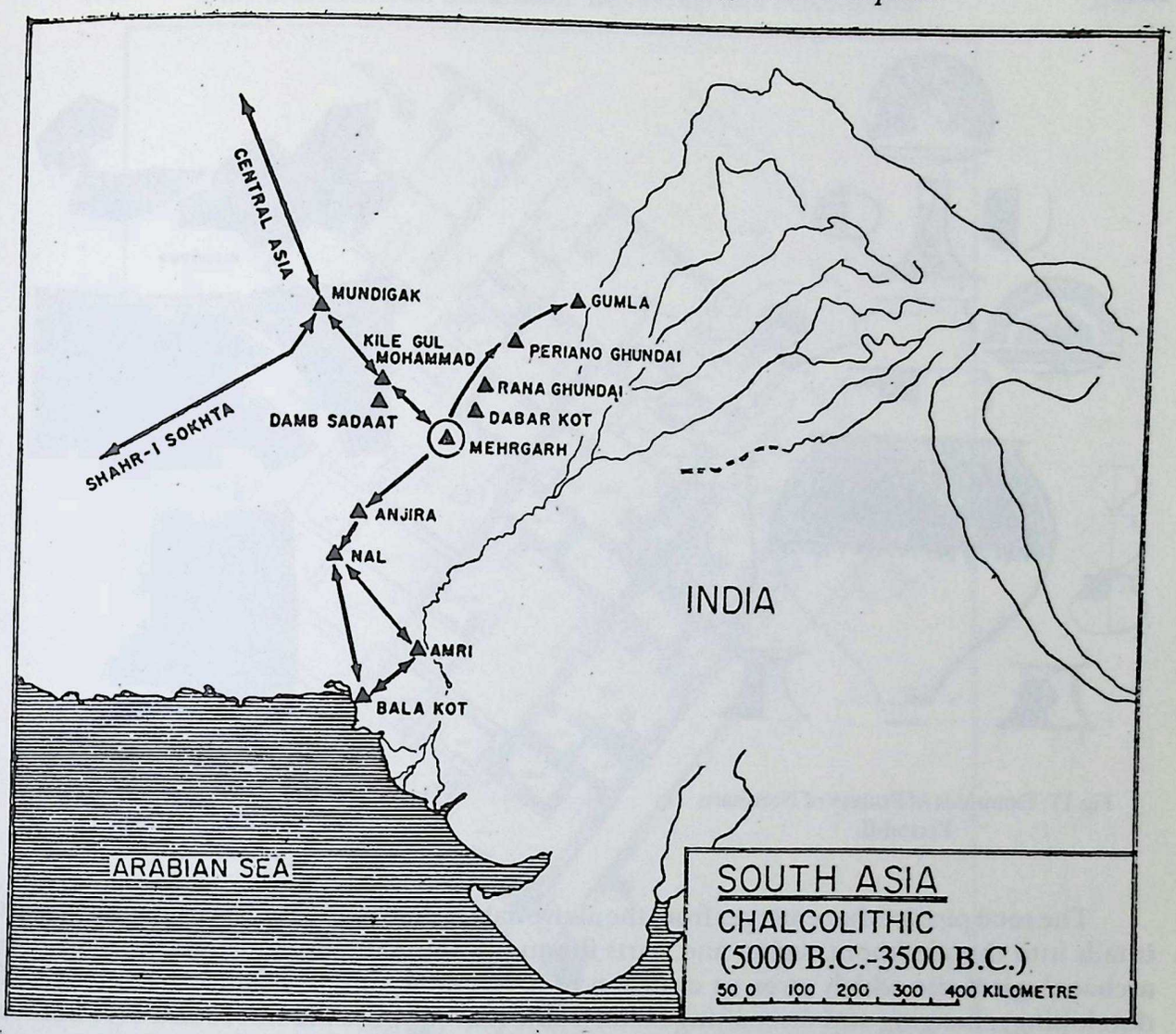

Fig.16: Map showing South-Asia Chalcolithic sites.

Kachhi, was fast developing into a city, and secondly, Nausharo had the constraint of the absence of large and stable landmass near a permanent source of water which did not change its course too often, Moreover, six km is hardly 'long distance' and, therefore in a sense, Mehrgarh and Nausharo formed part of a single geographical location, at times one locality was favoured while at other times the other was favoured for habitational purposes. Shifting sites was normal to all civilizations.

The cultural deposit of Nausharo is divided into two major periods, I and II. Period I is further divided into sub-periods A, B and C. (Fig. 17) I-A ties up not only with Mehrgarh VII-C, but also with the Early phase of Mohenjodaro, though at Mohenjodaro it is only imperfectly known, the Early phase of Chanhudaro, and the Amri III-A level, just as it ties up with Kot-Diji. Nausharo IC has yielded evidence of monumental structures, besides pottery with fish-scale designs in black over red (Fig. 18). Everyday plain and painted vessels of the Mature Indus-Sarasvatī Civilization as found at Mohenjodaro and Nausharo IC are common, a fact which shows that by Period IC, Nausharo became part of the newly emerging social and cultural system, even though it itself never developed into a city (Fig. 19).

This shows quite clearly that the urban phase of the Indus-Sarasvatī Civilization was the product of a widespread process of socio-economic change involving many sites which were closely interacting with each other at various levels of production and distribution.

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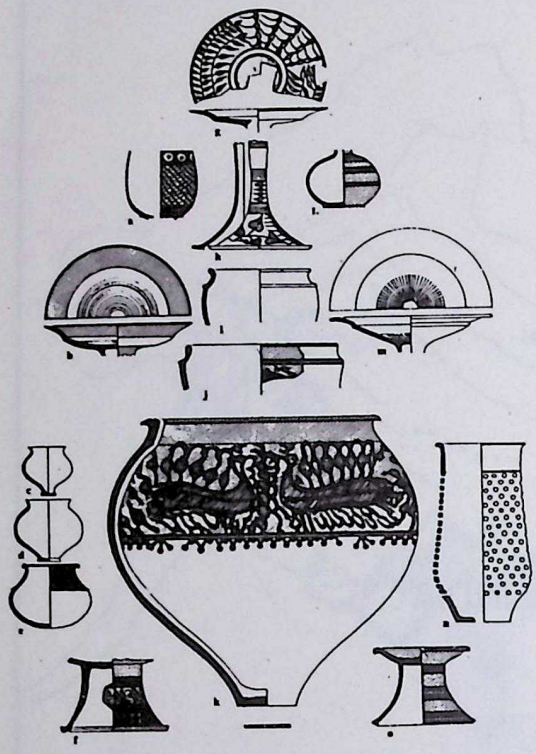

Fig.17: Examples of Pottery of Nausharo Period-II.

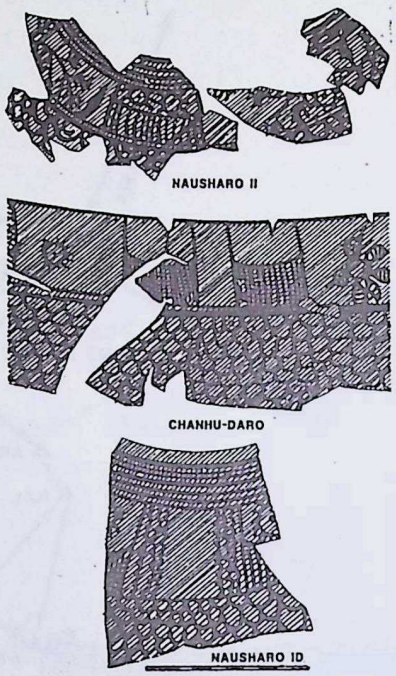

Fig.18: Examples of Pottery of Nausharo Period-I and ID.

The total picture that emerges from the above data is that on the Belan river, at the point it falls into the piedmont region and starts flowing in the Kachhi plains, we have now an archaeological site which gives us evidence of a very long and continuous sequence of developing, changing and diversifying cultures, the like of which was not found ever before in India. Starting from the Pre-pottery Neolithic (late eighth millennium), the site witnessed growth to the stage called the 'Formative Period' of the Indus-Sarasvatī Civilization (late fourth millennium), followed by the 'Early Period' Indus-Sarasvatī Civilization (late fourth millennium). In between there was 'a Transition Period' of around 200 years. The settlement then shifted to a nearby place called 'Nausharo'. The Mehrgarh Period VII-C, therefore, marks the end-phase of human settlement at Mehrgarh and also the first phase of human settlement at Nausharo (Period I). Both are marked by Kot Diji or the Early Indus-Sarasvatī Civilization which, in terms of the village-city syndrome, is called 'proto-urban'; Nausharo Pd. II, on the other hand, represents the Mature Indus-Sarasvatī Civilization, i.e., the cultural stage called 'Developed' or 'Mature' or 'Urban' even though Nausharo itself never reached the level of 'big city'; it had only close contacts with big cities like Dabar Kot and Mohenjodaro.

We have thus enough archaeological evidence from the Bolan sites like Mehrgarh and Nausharo about the Formative Period (early to middle fourth millennium) and the Early Period (late fourth to early third millennium). The 'Transition' is placed between 2800 BC and 2600 BC. During these periods, it may be noted, people had developed a number of crafts and a network of trade routes to make them move even to distant places. The trade and trade-routes were now firmly established.

The exploitation of the flood-plains of the Indus for intensive agriculture, hence carefree and comfortable settled life, was the single most important factor which brought people from the highlands of Baluchistan to the lowlands of the Bolan and Indus basins. Since

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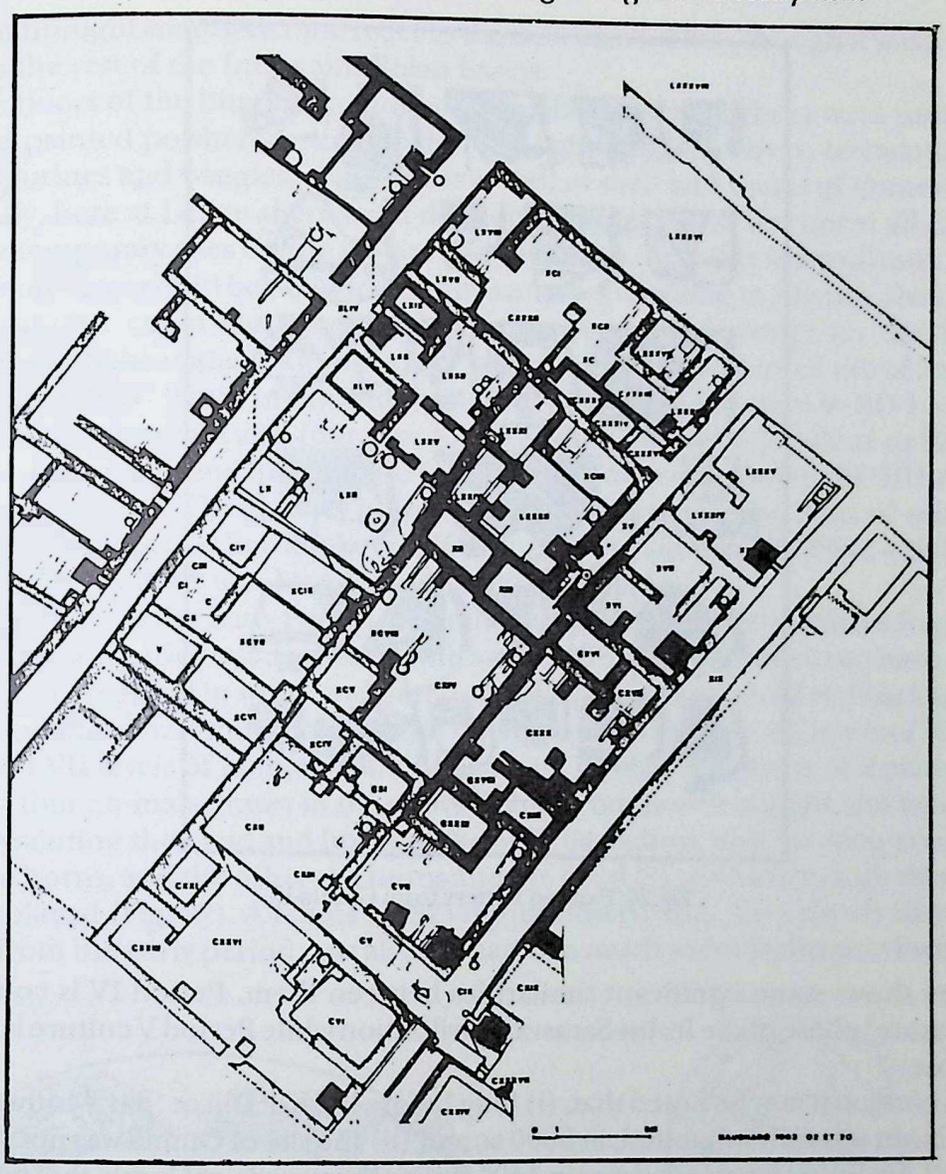

Fig. 19: Plan of Residential Area, Nausharo -II.

they had prior knowledge of domestication of animals and plants, painted wares made on wheels, house-building techniques, stone and terracotta working and metallurgy, they had hardly any difficulty in establishing their first villages when they moved into the lower Indus basin at sites like Amri and Ghazi Shah. Similarly, the Gomal and Bannu basin witnessed the birth and growth of some other elements of the Early Indus-Sarasvatī Civilization such as the graffiti, particularly at Rehman Dheri, which perhaps later on developed into a script. These cultures also spread in the Indus basin and contributed significantly to the formation of the Mature Indus-Sarasvatī Civilization.

From here we move on to northern Baluchistan. In the Upper Indus and the Suleimans, Neolithic settlements in temporary shelters with rammed floors and storage pits have come to light in recent years. The people at these places used red, buff and grey pottery, both handmade and wheel-thrown, plain and painted. Villages of this kind emerged at sites like Lewan in Bannu valley and at Gumla in the Gomal valley. The use of stone tools—blades, flakes, polished axes, arrowheads, etc., was common. Though Lewan ends at that level of culture, the Neolithic Gumla very soon developed a Chalcolithic culture—the use of copper, mud and mud-brick houses along with painted and plain pottery, including wheel-turned is fully attested (Fig. 20). Period II of Gumla appears to be contemporary with Kot Diji because,

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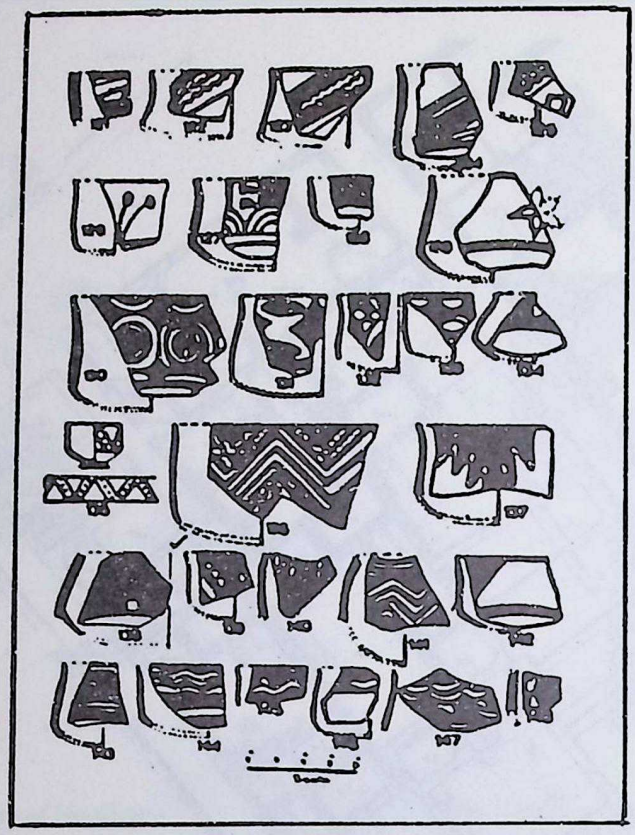

Fig.20: Painted Pottery from Gumla-II.

now, pottery shows some significant similarities between them. Period IV is contemporary with the 'Mature' phase of the Indus-Sarasvatī Civilization while Period V culture is of the post-Mature phase.

In this context it may be noted that, (i) long before the Kot Diji or 'Early Indus-Sarasvatī', the Gomal basin was fully inhabited, in 5000 BC and (ii) the site of Gumla was not deserted till the post- or 'Late Indus-Sarasvatī' times in 1400 BC. In other words, at Gumla there are remains of cultures bracketed between 5000 BC and 1400 BC as in the Indus and Sarasvatī basins. Thus, as a border settlement it kept on serving the entire course of the Indus-Sarasvatī Civilization even though it itself may not have witnessed the formation of a 'city' on its own land. Sites like Tarkai Qila, a few miles south of Bannu, had the same story to tell.

All these sites formed part of a very complex system in which procurement of raw materials, processing them for making artefacts, and then the distribution of the finished products were involved. The Kot Diji (or Pd. II) phase at Gumla is dated to 3100 BC as per the calibrated radiocarbon dating. Thus, by this date or the Early Indus-Sarasvatī times, a system of movement of men and materials had evolved in which 'acculturation' was becoming a major factor of cultural and economic life of the Indus-Sarasvatī people. It is common knowledge that 'acculturation' is a very dynamic process which throws up a series of 'challenges and solutions' leading to the birth of many innovations in technology and craftsmanship.

Lewan: Lying on the edge of the Indus plains, Lewan has yielded the remains of several cultures in the context of a single Neolithic complex starting from that belonging to the late fifth and early fourth millennium BC.[14] The people lived in small villages and faced cold and arid climate, with only about 300 mm of annual rainfall, although summer and winter floods

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very often brought some welcome relief to the cultivators. Thus, though it was a hill site, it was as arid as the rest of the Indus and Bolan basins.

The floors of the huts and a number of rubbish pits near them were found to contain plain and painted potsherds, stone tools, both light and heavy-duty, terracotta human and animal figurines and bangles, stone beads as well as shell and bones of domesticated cattle. Apparently, here at Lewan there was a developed village which was not at all unrelated with other contemporary sites on the Gomal and the Indus. And this is significant. Although no radiocarbon dates could be obtained on any sample, according to Allchin, the excavator, the culture-complex could easily be divided into three period-groups on the basis of their correlation with the materials found at the larger and better preserved site of Rehman Dheri, abbreviated as 'RD'. Thus, to the mid to late Early Period (equivalent to RD 1, dated to 3350-2850 BC) belong one hut and four pits; to the Middle Period (equivalent to RD II, dated to 2850-2500 BC) one hut and five pits; and to the late Period (equivalent to RD IIIL dated to 2500-1900 BC), three pits. These dates now stand some revision in the light of our present day knowledge: Early Period Earliest Level (4000 BC); Mid to late level (3500 BC – 2800 BC); Middle Period (2800 BC – 2600 BC); Late Period (2600 BC – 1900 BC).

The pottery of the Early Period is extremely significant. Pit 10 yielded a fragment of dish-on-stand whose interior was decorated with a zone of four fish, of which two have survived (Fig. 21). These are painted in white and outlined in black over an overall red background. A very similar form of fish was found painted on pots discovered in Period I levels of Rehman Dheri and Period VII levels of Mehargarh. The same pit yielded fragments of a painted bowl with figures of four animals drawn in the above fashion: two hornless goats and two boucrania—one representing the head and horns of the bull, *Bos indicus,* with hanging pompoms on the tips of the horns, and the other the horns and the head (?) of a buffalo with three *pipal* leaves similarly placed (Fig. 22). Allchins (1982) rightly observe that 'they clearly demonstrate that the site, from the early period, was already part of a much wider Indus province in which the

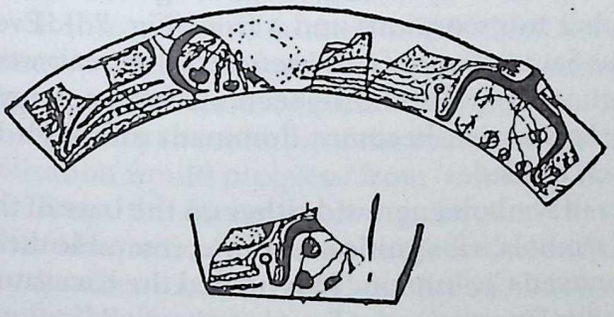

Fig.21: Pottery from Period II and III Lewan.

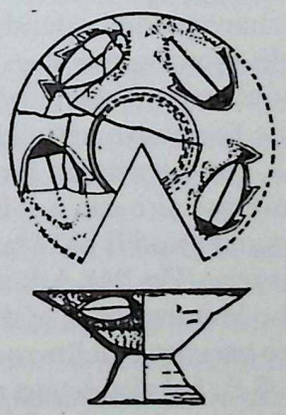

Fig.22: Painted Pottery from Lewan (I).

symbolism, which later becomes the inter-provincial currency of the Mature Indus civilization, was already present in a nascent form. In this light, the association of horned boucrania and *pipal* leaves is strongly indicative of religious connotation at Lewan no less than it is at Kot Diji, or later at Mohenjodaro or Harappa.' The Early Period of Lewan thus formed part of the Formative Phase of the Indus-Sarasvatī Civilization.

Terracotta mother goddess and bull figurines, some of them bearing thick black lines on their bodies, found at Lewan are similar to those found not only at Rehman Dheri but also Gumla. This too indicates that, even in this very early period, sharing of culture was not

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confined to material items but extended to religion and concepts related to supernatural, to motherhood, to the symbolic virility of the bull, etc., were equally important components. This 'inter-provincial currency' found adequate expression in the later periods also.

Belonging to the Late Period was a secondary deposit excavated in another area, called Site V. Besides copper fragments, lapis chips, two incomplete terracotta carts, is a lump of lightly burned clay which bears two identical seal-impressions of swastika on its outer face, and impressions of string and matting on its interior. 'This impression is entirely consistent with its dating partly to the Early, or even partly to the Mature Harappa periods, although it must be recalled that to date no characteristically Mature Harappan artefacts have been reported from Lewan or elsewhere in Bannu basin' observe the excavators. This validates our contention that the Indus-Sarasvatī Civilization had necessarily to incorporate non-Indus-Sarasvatī sites into its operational orbit from the very early times, the early fourth millennium if not the fifth.

Rehman Dheri: Rehman Dheri is the key-site of the region[15] for the Formative period as well as the Early period of the Indus-Sarasvatī Civilization. It starts (Period I) with a culture-complex in which the predominant pottery assemblage is absolutely local: there are only a few types with painted designs which recall the Kot Dijian finds. Thus like Lewan and Gumla, Rehman Dheri was also not an isolated settlement, but its contacts with the lower Indus basin were only marginal. However, Period II had a large number of Koṭ Dijian pots with motifs like *pipal* leaf, peacock,, intersecting circles, fish, etc. which, as is common knowledge, entered into the Period III pottery which represents the Mature Indus -Sarasvatī stage of developed urbanism. It is during this stage that we get even the 'knobbed ware' found at Harappa and Mohenjodaro, which at one time was unfortunately taken to be an import from West Asia. The presence of beads of carnelian, lapis lazuli, turquoise, agate, etc. indicates that the site formed part of long-distance trade network joining regions in the south as well as the north, i.e., from Gujarat to Turkmenia.

The site is very important from the point of view of seals and graffiti marks on pottery. Period 1 levels have yielded a pendant like rectangular ivory seal with engravings on both the sides—one side showing two stags and the other two scorpions and a frog (Fig. 23). Even though the motifs are different from the Indus-Sarasvatī motifs, the very fact that seals were used during the Formative period is significant; an overall authority seems to have emerged which later on got a complex form when urban system becomes dominant although its magico-religious use also can not be completely denied.

Pottery from Period II has a large number of symbols engraved either on the base of the pots or on their rims (Fig. 24). A dozen of these symbols, it is significant to note, resemble those used during the Mature phase of the Indus-Sarasvatī Civilization. This has led the excavator, F.A. Durrani, to surmise that the roots of the Indus-Sarasvatī script lie at least partially in these graffiti marks. B.B. Lal also seems to subscribe to the view that these as well as other graffiti marks on pottery found at other Baluchi sites were the source for the Indus-Sarasvatī writing. Though not proven, this may well be true since the Indus-Sarasvatī script was entirely different from any other known contemporary scripts in West Asia. Thus, in an indigenously developing system of 'culture' as a whole, the birth of the Indus-Sarasvatī writing indigenously is perfectly logical.

It may be noted that mud-brick houses, mud-brick platforms and mud-brick fortifications were made here in Period II itself, which proves beyond doubt that the element of monumental structures for public utility characterized the Early Period of the Indus-Sarasvatī Civilization, beyond the basins of the Indus and the Sarasvatī also.

The evidence is, therefore, in conformity with what we get at Amri and Kot Diji. Monumental public architecture came into vogue much before the emergence of the Mature phase of the Indus-Sarasvatī Civilization; the latter only elaborated the efforts of the former.

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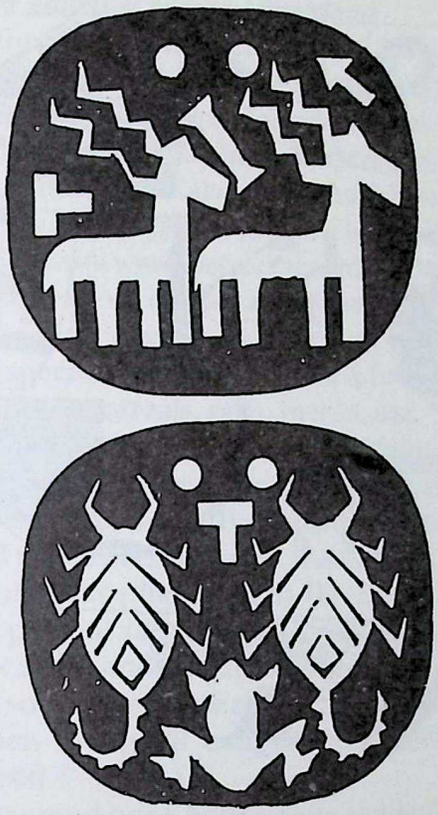

Fig.23: Seal from Rehman Dheri.

In other words, the directional changes in the Early Indus-Sarasvatī Civilization were fully set by 3500-3100 BC if not earlier.

Rehman Dheri I is dated to 3380-3040 BC or 3500-3000 BC bracket. At Kot Diji, the Kot Diji culture, or the early level on the citadel mound, is dated to 3370 BC and 3300 BC. This is also the date of the earliest levels of the Early Indus-Sarasvatī Civilization at Harappa. This also shows that by the middle of the fourth millennium itself it became clear as to which way the civilization would progress: from 'township' to 'city' and from 'city' to 'mega city'.

From the foregoing it may be seen that there were several kinds of experiments in culture-formation made in the piedmont and the lowland river areas from the middle of the fourth millennium BC, but their directional changes were the same. Hence, they could evolve eventually a single form of culture-complex, called the Indus-Sarasvatī Civilization, in which rural and urban forms not only coexisted but also supplemented each other. It is fully established in the Mughal's work in Cholistan.

And this is most significant for understanding the nature of the 'Vedic' or 'Aryan' or 'Vedic Aryan' civilization of ancient India. It is now more or less clear that, once the people started understanding the benefits of living in the flood-plains of rivers and, of course, the constraints of the floods too, for which they devised the simple method of erecting high platforms of mud and mud-bricks to build houses on the next step of establishing large permanent settlements, bounded by protective walls, 'fortifications', was only a matter of time, since it only meant more families coming together and working together in a corporate manner for items required for the common good, for example for erecting the Pillared Halls and the Great Bath at Mohenjodaro. In other words, it required some kind of corporate life with community decisions which would be honoured by most of the inhabitants and

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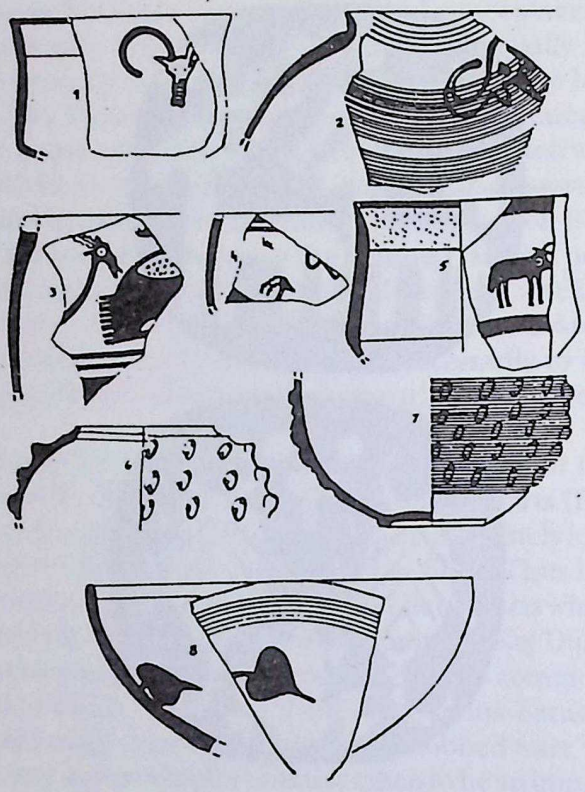

Fig.24: Rehman Dheri: Pottery from Period II and III.

implemented with a superior overall controlling authority vested in one individual, or in a few individuals. Which form(s) of centralized authority was adopted, it is just not possible to determine at this stage of the research. Once successful corporate life was achieved at one or two places, the idea must have caught on like wildfire, even without an emperor to enforce it. That is what seems to have happened during the Kot Diji or Early Indus-Sarasvatī periods, when the first fortified townships were established, for example at Kalibangan. Hence, this stage is rightly called 'Early Indus-Sarasvatī' or Early Harappan Civilization. The next giant step towards a full-fledged or developed urbanization could no longer be a distant dream as seen evidenced by developments at Harappa and Kalibangan where large cities emerged soon after, though it took at least 200 years of 'transition period' between the last leg of the Early and the first leg of the Mature phases of the Indus-Sarasvatī Civilization. As a matter of fact, it was the logical end of the success of the long process of development of corporate life during the 'Kot Diji' times, but which had certainly begun much earlier, during the Formative period.

The fourth millennium, therefore, was a turning point in the history of India. The piedmont regions of the Kirthar and the Suleiman in Baluchistan witnessed the birth of Neolithism in the eighth to seventh millennium BC. For about three thousand years it kept on developing a socio-economic pattern which achieved many technological breakthroughs in metallurgy, settlement planning and social formations based upon corporate life and long-distance exchanges. All was now set to move on to the plains of the Indus and Sarasvatī. From 3500 BC this movement started and by 3300 BC we see people establishing large and permanent settlements there and it became clear that the people would not go back to the hills, i.e. Neolithism although as a form of culture it persisted at many places.

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The Early Settlements in the River Valleys of Indian Hinterland

It was during the early fourth millennium, may be fifth, that many groups of people moved in a big way, down the Baluchi hills and the piedmont regions along the Kirthar and the Suleiman into the river basins of the Indus, Sarasvatī, Ravi, Gomal, etc. Discoveries made in recent years indicate that this process may have started in 5000-4000 BC at Harappa itself. They settled down at Balakot, Amri, Miri Kalat and Ghazi Shah in the lower Indus in Sindh around the same time. Harappa and Jalilpur on the Ravi in the Punjab and Hakra Culture sites in Bahawalpur region on the Sarasvatī were also occupied during this period. The first villages in the plains were built using stone tools, copper implements and mud bricks. Painted pottery is also found at these sites. The settlers started cultivating fields and domesticating animals while continuing to hunt wild species. Incidentally, this is fully reflected in a number of Vedic hymns which talk about cows, bulls, cereals, pots, bricks, etc.

Amri: Some 160 km south of Mohenjodaro and less than two kilometers away from the Indus, on its right bank, there are two mounds close to each other, the bigger one, called 'A', around 40 feet high, and the other, lower one, B, around 13 feet high (Fig. 25). The site, called Amri, was excavated twice by French archaeologist Jean-Marie Casal.[16] Period I, or the lower level culture, is subdivided into four phases, IA to ID. Level IA, (Fig. 26) representing the lowest phase, has yielded 82 percent of handmade pottery, the rest is wheel-turned, thin-walled, yellowish or pink in colour and better finished. The paintings include geometric designs done in black, though sometimes these are bichrome—red and black. A few terracotta beads, some scraps of copper, and shell bangles complete the culture repertoire. No permanent houses were noticed.

Phase IB is important. Now mud-brick houses were made for the first time. Wheel-turned painted pottery of Togau or Mehrgarh III type now occur in increased proportion. This shows that from then onwards there was no looking back, the lowland river-valley advantages convinced the highlanders once and for all that more comfortable and permanent settlements could be established in the new environment. The settlement of Phase IC has bichrome as well as trichrome pottery (Fig. 27) which is also analogus to Kot Diji pottery.

This (IC) was the most crucial stage since it is found represented at very many places in the Indus and Sarasvatī basins. From this phase we get Kot Diji-Harappan related pottery and we now decisively enter into the proto-urban phase. Amri, therefore, clearly establishes the fact that the Harappan was a very late affair at the site (ID) but Kot Diji or Early Harappan or Early Indus-Sarasvatī (IC) pottery also appeared later than the IA and IB occupational periods. In other words, IA and IB together represent pre-Early Indus-Sarasvatī occupation or the occupation of the site during the Formative Period of the Indus-Sarasvatī Civilization, called 'Formative Harappan' or 'Formative Indus-Sarasvatī' Civilization datable to the early to mid fourth millennium because the habitational levels of IC and ID are dated to 3375-3020 BC or 3500-3000 BC bracket. The Amri evidence, therefore, clearly establishes the Four Stages concept for the beginning of the Indus-Sarasvatī Civilization: Stage I the Formative Period, Stage II the Early Period, Stage III the Transition to Mature Period, and Stage IV the 'Mature Period'. It is followed by the 'Late Period'.

Balakot: The site of Balakot lies in the middle of the Khurkera alluvial plains on the south-eastern side of the Las Bela Valley and Sonmiani Bay. It is situated in the Las Bela District of southern-most Baluchistan and is about 88 km north-west of Karachi. The excavations at the site were conducted by the University of California from 1973 to 1976 under the direction of G.F. Dales (1974: 1-22; 1979: 241-273). Balakot did not come in prominence till 1960 when Robert L. Raikes visited the site and pronounced that it was a Indus-Sarasvatī seaport, since in Baluchistan District Gazetteer of 1903 it was mentioned only as an ancient site.

The mound measures approximately 180 x 144 m with an area at plain level of about 2.80 hectares. It is about 9.70 metres high from the surrounding plain.

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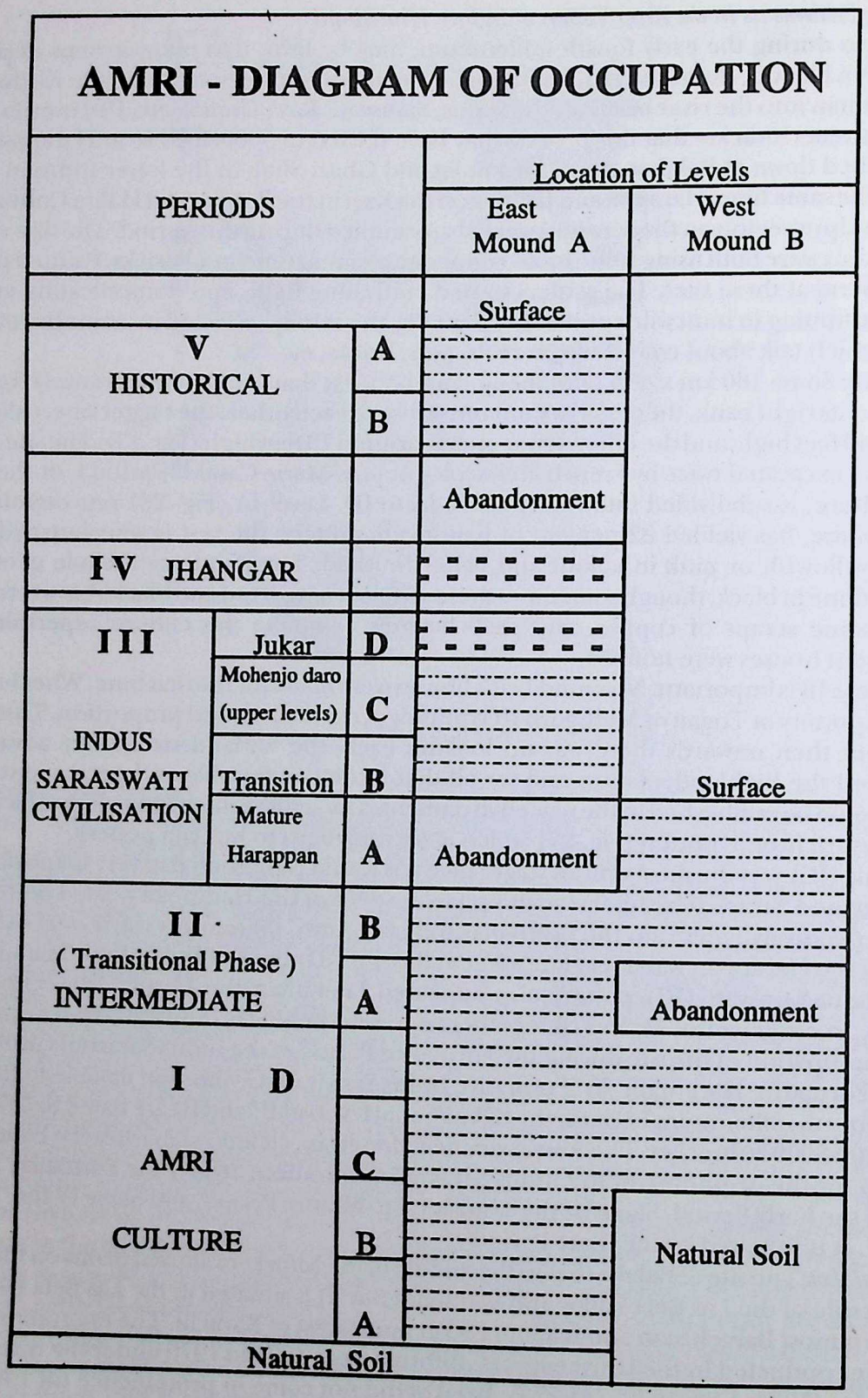

Fig.25: Amri, Diagram of occupation.

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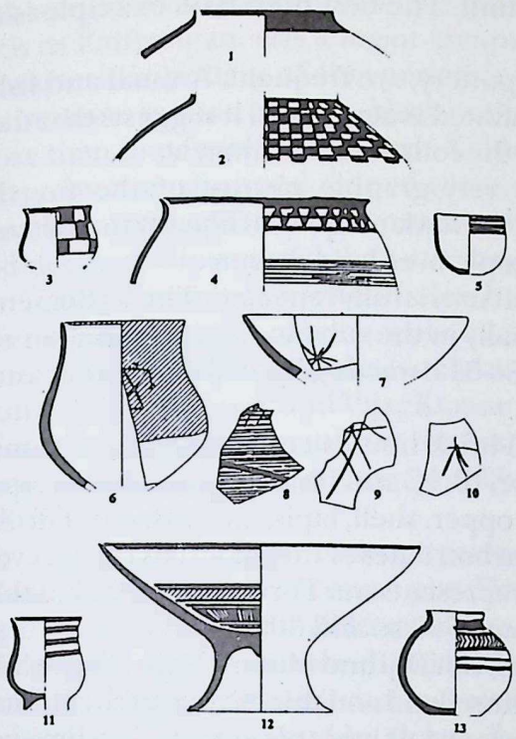

Fig.26: Amri: Pottery, period IA.

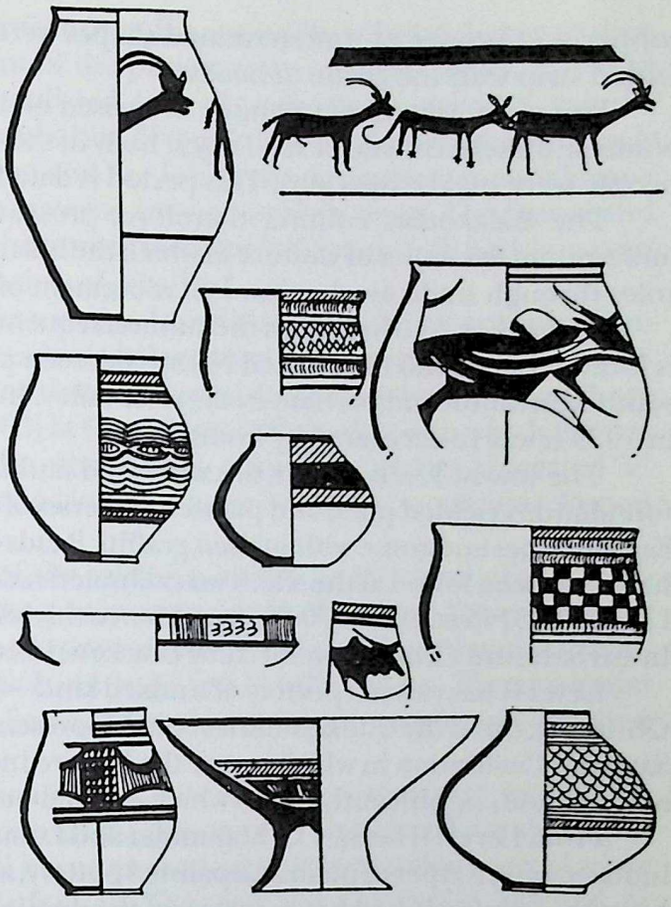

Fig.27: Amri Ware—Representative types.

Excavations have yielded three period sequence at Balakot:

Period III	—Post-Harappan and Islamic
Period II	—Harappan (Mature Phase of th Indus-Sarasvatī)
Period I	—Balakotian

Period I: It represents the earliest occupation at this site, just above the virgin soil and was designated by the excavator as Balakotian. The structural remains containing pottery and faunal remains on their floors have been encountered. They seem to be of domestic nature. Mud-bricks, measuring approximately 10 × 20 × 40 cm, were used for walls and pavings. The pottery is wheel-turned and decorated with painted motifs, familiar from the other early sites in southern Baluchistan. The most striking examples, present throughout this period, in both form and decoration, are directly related to the Nal Polychrome Ware.

'In broad terms our Period A (I) can be described as belonging to the basic Nal tradition of southern Baluchistan with infusions of other south-central Baluchistan tradition such as are best known from the Anjira sequence of Kalat', observes Dales (1974).

Togau C style pottery has been found in the lowest levels of Period I and thus connects it with the Anjira ceramic traditions. The two occupational phases of Period I witnessed the presence of Amrian pottery in large number along with Nal pottery. Painted styles connect Period I with the Amri C and D.

Other finds included clay figurines of humped bull, chert/flint blades, edged tools, chipped stone stools and retouched microliths, lapis lazuli beads, shell beads, and beads of semi-precious stones and paste. Metal is very rarely used in Period I. For items of metals,

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copper and bronze of undetermined shapes were found. The best preserved example is a folded strip with the cache of beads.

Potters' marks, either painted or incised on the pottery, are frequent. Animal and fish bones and shells constitute the largest body of the excavated material and it suggests that the people were meat eaters also. This period is dated to the fourth millennium BC.

The Balakotian culture, therefore, presents a very graphic picture of the fourth millennium dynamics of Culture in which the hills and the lowlands played equally important roles through trade mechanism and movement of people over long distances.

Ghazi Shah: At Ghazi Shah the cultural sequence of Amri is fully repeated. The settlement is located on a small river called Naing Nai, seen partially in the sub-mountainous region of south-west Sindh and partially in the river valley. In 1930-31 it was dug by N.G. Majumdar and in 1985 it was re-excavated by Louis Flam.[17]

The lowest levels of this site with mud and mud-brick houses constructed over stone foundations yielded plain and painted potteries of Amri IB, IC and ID types, along with some Kot Diji types and some with incised graffiti. Beads of copper, shell, lapis, etc. with chert drills have also been found at the site. Two calibrated radiocarbon dates of the materials from Level I are 3375-3145 BC and 3370-2970 BC. Hence this level represents our Formative Period of the Indus Sarasvatī Civilization, broadly bracketed between 3500 BC and 3000 BC.

Level II has yielded pottery of a mixed kind—Amri, Kot Diji and Mature Indus-Sarasvatī. Obviously, this is the transitional level and represents the second and third stages of the Indus-Sarasvatī Civilization in which we see the Mature Indus-Sarasvatī types of pots, etc. in a limited number and, significantly, types which evolved out of the Kot Diji-Sothi Types.

From Level III both N.G. Majumdar and Louis Flam recovered large amounts of Mature Indus-Sarasvatī types of plain and painted pottery, an evidence which undoubtedly proves that now the settlement had become part of the developed urban system of the fourth or Mature Phase of the Indus-Sarasvatī Civilization.

Kunal: The recently excavated site of Kunal (Lat. 29° 30´ N and 75° 41´ E long.) is in tehsil Ratia of Distt. Hissar in the State of Haryana. It can be approached from Bhuna, a town about 12 km from the site. It is located on the banks of a now dried-up course of the Sarasvatī. The settlement is not more than three acres in extent; the hub is still smaller, only half of it. The total occupational deposit is only around 3.10 m. It has been excavated by J.S. Khatri and M. Acharya (1995) on behalf of the Haryana State Dept. of Archaeology for the last four years. It is one of the most crucial sites which has left archaeological records of the process of change which led to the formation of the Mature Indus-Sarasvatī Civilization. Initially, the land was slightly undulated and also low hence the first settlers brought from nearby region huge quantities of red *kankari* soil and dumped here to make the land even as well as raise the general level of the ground by about 9.71 m. That the people started living on this artificially raised ground is clear enough from the construction of the dwellings.

A dwelling in the site has been found consisting of two units, one round hut and adjacent to it one refuse pit. What is, however, also significant to note is that the dwellings were semi-subterranean, sometimes called 'pit dwellings'. It is usually 2 m in diameter and 1.10 m in depth with rammed floor and smoothened walls. The pots are found cut through not only the artificially raised red clay platform of 0.71 m thickness but also the natural soil below the platform. The discovery of a few post-holes around the dwelling pits dug on the ground level plus the rather shallowness of the pits proves beyond doubt that at least 2 m high wattle-and-daub structure of a hut was raised above the ground.

The pottery repertoire is equally very significant. It is dominated by the so-called Hakra Ware found in the lowest levels of Jalilpur and is devoid of several Kalibangan I fabrics. It has also a handmade 'black-and-red' ware. There is also a dull chocolate coloured burnished ware with paring marks, the like of which has not been reported from many sites. A dull red ware

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with wavy incised decoration on the outer surface found at several Early Indus-Sarasvatī sites, such as Kalibangan, was a major component of the pottery repertoire. However, the most characteristic pottery of this period is the dull red (or red washed) pottery with painted decorations in two colours—black outline and white filling. It is in profusion; quantitatively more than that found at Banawali, Kalibangan and Kot Diji. Some designs are monochrome also, criss-cross diamond shaped geometric patterns done in black or sepia. The faunal and floral painted motifs are most noteworthy, the former includes bull heads with highly curved and decorated horns and the latter large variety of *pipal* leaf.

The cultural complex includes, besides a very rich and almost exclusive pottery repertoire, a large number of bone tools, micro beads of chalcedony and copper implements such as arrowheads and fish-hooks. It may be noted that a number of arrowheads resembled those found by R.C. Agrawal and Vijay Kumar (1983) at Ganeshwar in Rajasthan—in which the two sides show marked curvature at the base. The other type is, of course, the usual Inverted 'V' shaped with sides absolutely straight. The period in which these occurred is termed as 'Period IA'.

Period IB represents the expansion of the settlement and construction of the semi-subterranean houses of round pits. First, the pits increased by 1/2 to 1 m; these huts now measured 2.64 m, 2.75 m, 2.92 m. Moreover, the pits were now lined with finely moulded mud-bricks of very special sizes such as 11 × 24 × 39; 10 × 20 × 37 and 11 × 23 × 38 cm. The maximum number of courses found intact so far is five. Some of them have brought to light well designed and well-constructed mud brick hearths.

The pottery-repertoire of Period IA continues to occur in large numbers, mainly the bichrome red ware using black and white colours for paintings of faunal and floral designs, including the bull head, with highly curved horns marked with three parallel lines of white and black colours alternating in a rhythmic fashion. The *pipal* leaf, beautifully hatched, or solidly filled, or else leaf-within-leaf pattern, using black, sepia and white colours, presents the most popular, and perhaps the most sacred, motif.

More significantly, now we get practically all the six Kalibangan I or Early Indus-Sarasvatī Fabrics in pottery, including the grey ware, internally incised red ware, pots with roughened surface at the bottom achieved by splashing wet clay, etc. These are also the potteries found in the Early Indus-Sarasvatī levels of Banawali, Siswal, and other sites on the Sarasvatī and Dṛṣadvatī rivers. The black-and-red ware, it may be noted, also continues to occur in small quantities and so also the plain dull chocolate coloured burnished ware with paring marks on thick fabric, the like of which is comparatively very rare at other Early Indus-Sarasvatī sites.

But what is most significant from our point of view is the first occurrence of red sturdy ware pots of well-levigated clay. Some of these pots have forms nearest to the 'Classical Harappan' or Mature Indus-Sarasvatī forms, such as beakers and jars. We have clearly observed the beginning of Mature Harappan shapes, fabric, thickness, etc. but in dull red ware, grey ware and dull chocolate ware. Banawali also has yielded similar wares. We have from this level terracotta cakes also.

Period IC represents the real Transitional Phase between the Early Indus-Sarasvatī and Mature Indus-Sarasvatī culture-complexes. The dwellings changed from the semi-subterranean huts to regular square and rectangular houses built of standardized mud-bricks on the ground level which was further raised at various points to provide height and stability to the living quarters. The bricks-sizes, it may be noted, had two ratios: 1:2:3 and 1:2:4 (9 × 18 × 36 cm; 11 × 22 × 44 cm; 12 × 26 × 39 cm; 11 × 22 × 33 cm), both used simultaneously, while it is generally believed that the former ratio was adopted by the Early Indus-Sarasvatī people, or the Early Harappans, while the latter was adopted by the Mature Indus-Sarasvatī people. It is common knowledge that 1:2:3 ratio bricks can not always produce the so-called 'English Bond' architecture in which the joints always fall in the middle of the bricks of the upper and

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the lower courses while the bricks of 1: 1.5:3 ratio produce perfect 'English Bond,' a feature that produces maximum strength to the structure and saves it from falling apart in blocks. It further establishes the fact that the Mature Indus-Sarasvatī technologies started appearing in the Early Indus-Sarasvatī times in the field of architecture also.

Further, the houses, though extremely modest in dimension and elaboration when compared to those of the Mature Indus-Sarasvatī period, developed drainage system also comparable to at least one of the most popular types used at Harappa, Mohenjodaro, Kalibangan, Banawali and Lothal—soakage jars fixed in the streets to receive sullage water directly from the house drains. Even soakage pits were made to do the same job. Both the devices were adopted to keep the streets neat and clean. The discovery of refuse pits further helped the people not to choke the lanes and streets with household rubbish.

It is sometimes believed that the Early Indus-Sarasvatī people did not develop devices to store grain but at Kunal, during this period we do find round silos or pits plastered with *chunam* and clay mixture.

Period IC has been divided into three structural phases—IC (i), IC (ii) and IC (iii). And significantly these structural phases also exhibit features which clearly demonstrate developing stages of culture. Each one is marked, it may be noted, with the feature generally labelled 'change with continuity'. The houses, the drainage system, the street, etc., did not change much except for the fact that as time passed, the dwellings became slightly larger and better built. And this is not too surprising because the site remained throughout its existence as only a village.

Phase IC (i) is the most significant phase. In one of the rectangular brick houses, the excavators found a virtual treasure of gold and silver ornaments placed in a vessel of silver sheet and buried in a plain simple dull red globular pot of Early Indus-Sarasvatī fabric. The silver objects include two tiaras (head-gear ornaments), one small and the other large, each in the form of a large and fully opened flower having petals topped with a *pipal* leaf sign somewhat resembling the Greek letter alpha. (Pl. I) Never before such magnificent objects were found at any Harappan or Indus-Sarasvatī site. And this is not all. Along with these were found two silver tiaras *(mukuṭa)* one large silver object with horizontal mouldings used as armband ornament. This too is a unique object. The three may have been meant for or else belonged to some one socially distinguished like *rājā*, because not only the forms of the objects but also because the metal silver is absolutely foreign to the region and must have been very costly. As a matter of fact, the objects themselves are exotic but since at no other place such ornaments of elite association have been found, it is difficult to hazard guesses about the place of their origin. It is possible though not proven that these were meant to be sent to some one in a large city, for here they were only fashioned.

From a different cache, found in another house of the same period, a large hoard of gold ornaments with disc beads, cup-shaped beads, round sheet beads with thread-channel, barrel-shaped tubular beads with facets all over the surface, etc. have also been found. Beads in terracotta but of shapes identical with the metal ones are found from several houses. Similarly, large hoards of beads: 5690 lapis lazuli micro-beads, 3370 carnelian beads, 2806 steatite beads, 487 shell beads and 92 beads of agate make the whole gamut of luxury items as richest when seen in the context of the rural nature of the settlement and transition from the Early to Mature Indus-Sarasvatī culture-complex.

But this is not all. Most of the shapes were similar to those found at Harappa and Mohenjodaro in the levels belonging to the Mature Period. This too proves beyond doubt that Mature Harappan or Indus-Sarasvatī types of stone and precious metal beads were manufactured decades before the emergence of the Mature phase of the Indus-Sarasvatī cities. And this includes classical faience and carnelian beads too. Small chert blades of the types found at Mohenjodaro and Kot Diji are also found at the site.

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Significantly, copper objects are also of the so-called Mature Indus-Sarasvatī types, e.g., coiled finger rings, coiled cones, inverted 'V' shaped arrowheads, flat axes, fish-hooks, spear-heads, etc. There is at least one copper-smelting furnace found at the site; there may be a few more. From here a classical example of terracotta-crucible with molten metal still sticking to the inner surface of the vessel has came to light. Undoubtedly, therefore, the copper ingots came from some other site because the site was far from the known resource areas, but the objects were manufactured locally. Similarly, one pottery kiln has also come to light which too establishes the fact that all kinds of pottery were locally made and produced.

And above all, the discovery of as many as six steatite and one shell seals makes it absolutely clear that typical Mature Indus-Sarasvatī square seals with knobbed back alongwith a hole were made centuries before the emergence of the large urban centres in the Sarasvatī and the Indus basins. The seals, however, bear only geometric designs, but all of these are found in the Mature Indus-Sarasvatī context as well. None of them is inscribed.

In this context it may be noted that at Dholavira (Bisht, 1991) in Kacch square steatite seals with knobbed back and decorated front were also found from Stage III levels, marked as Transitional. Significantly, the Dholavira seals bear human and animal pictures also, some composed in the narrative style similar to those found at Mohenjodaro in the Mature Indus-Sarasvatī context, for example one with a row of the so-called 'priests'. But no inscription.

The evidence of this kind goes a long way to prove that the system of pictorial seals and sealings was introduced in the Early Indus-Sarasvatī context itself. Internal trade-network had emerged, therefore, long before the Mature phase.

Harappa: The sequence of cultures was found repeated at Harappa (Fig. 28) by Mortimer Wheeler in 1946. In pre-fortification levels, represented by layers 26 and 26a, there is the pottery of the highlands, of 'Baluchistan Origin' with shapes and paintings of Amri IB type, the same as the Mehrgarh III type. In the limited area excavated, no house remains were found by Wheeler but on the basis of knowledge gained from elsewhere Kot Diji to Rehman Dheri

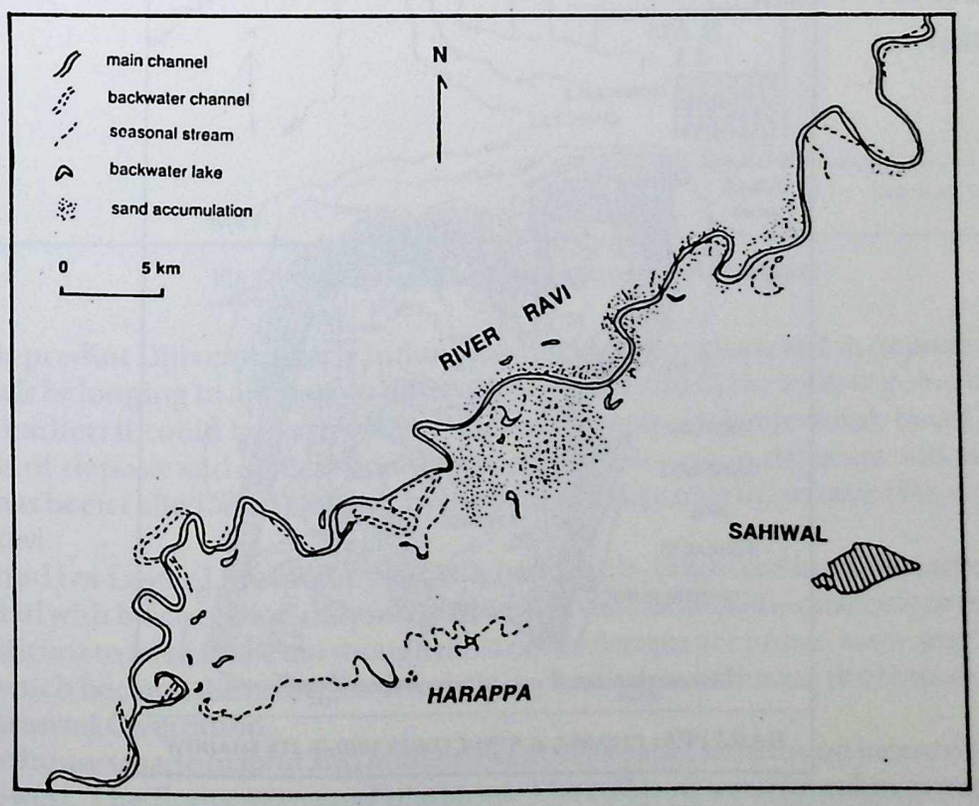

Fig.28: Map showing Location of Harappa.

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as also re-excavation of Harappa by Dales, Meadow and Kenoyer—it is now absolutely clear that there was a regular fortified settlement with massive mud-brick structures and houses of the Kot Dijian type which long preceded the mature phase of the Indus-Sarasvatī Civilization. It is dated to 3300 BC and was thus at least 600 years older than the first Mature Indus-Sarasvatī settlement established at the sites. It was exactly the same story as seen at Kot Diji.

Epoch-making Discovery at Harappa: Ravi Culture

The 1946 discovery of Pre-Defence levels (i.e., pre-Mature Indus-Sarasvatī) pottery, supposed to be of Baluchi origin, seems to belong to the Early Indus-Sarasvatī or Kot Diji times. Till 1995, it was taken to be the earliest period of occupation of Harappa. In 1996, however, almost all of a sudden, this supposition got the biggest jolt. One of the girl students, accompanying the American team of archaeologists headed by Richard Meadow and Mark Kenoyer, found in the dirtiest spot of the AB Mound, where people used to ease themselves, identified by Wheeler as a 'major gateway' (Fig. 29), because of the deep angular cleft in the high mound located on the northern shorter side of the fortified trapeze, found a number of handmade red ware sherds, some of which bore black paintings. These pot-sherds were picked up almost from the lowest levels of the exposed section (Appendix IV). When the

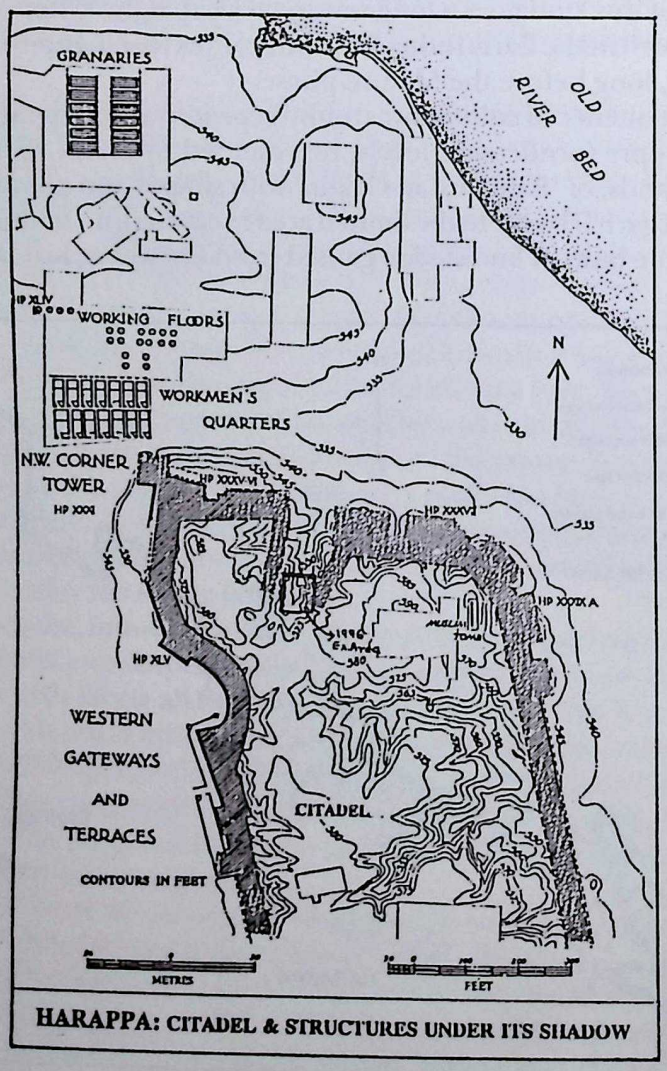

Fig.29: Map showing AB mound and the Gateway at Harappa.

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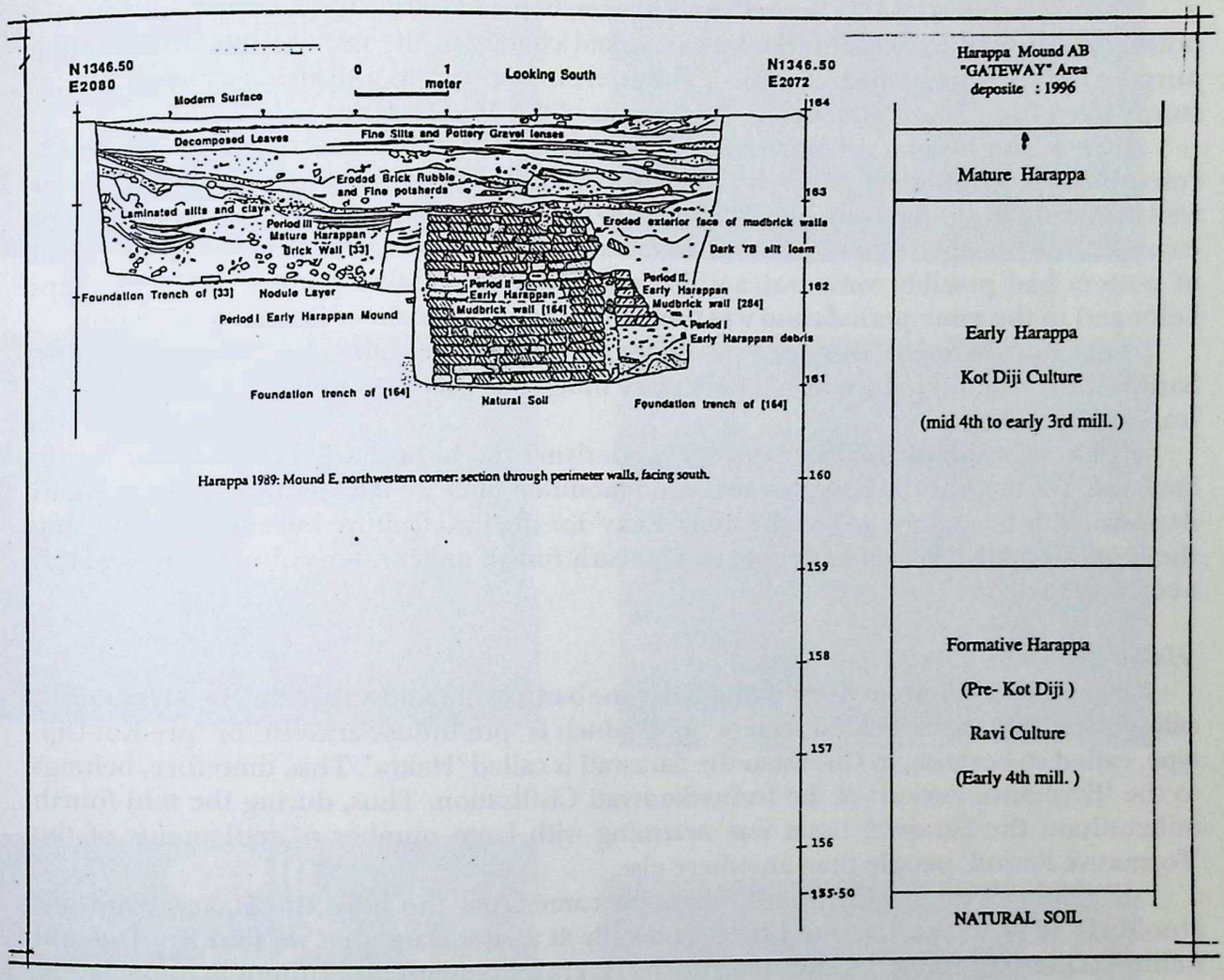
leaders of the team saw them they immediately realised that never before such a pottery was found at Harappa; not even by Vats, Marshall, Wheeler and Dales who had excavated various mounds at Harappa. Since these were found from the levels much below the Kot Diji ones, their value could be invaluable, thought the excavators. And when excavated this in fact turned out to be true (Fig. 30).



Harappa 1989: Mound E. northwestern corner: section through perimeter walls, facing south.

Fig.30: Map showing sequence of cultures at Harappa.

This pre-Kot Diji or pre-Early Indus-Sarasvatī level is as much as 4 m deposit with several floor-levels belonging to at least two different periods, I and II, the former going back to 4000 BC if not earlier; it could be even 4500 BC. But admittedly it is conjectural, based only on the thickness of deposit and several floor-levels, since radiocarbon dates are still awaited. This deposit has been called 'Ravi Culture' by the excavators, primarily because Harappa is located on the Ravi.

Period I or Lower Level pottery is totally handmade, bright red in colour, several of which are painted with black colour; only rarely white was used as an additional colour for paintings. It is significant to note that even though most of the designs are linear, some are 'intersecting circles' which became the most characteristic decorative motif during the Mature phase of the Indus-Sarasvatī Civilization.

The houses made of mud and mud-bricks of 4:2:1 ratio, were found oriented north-south and east-west. The floors were mud-plastered. The full pots were found in groups located in the corners of the mud houses.

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The movable antiquities which came out from the regular excavations included chert blades, bone tools, micro-beads of glazed steatite and several copper objects. It is significant to note that from these levels the excavators recovered marine shells which are found in the shallow seas of the Makran Coast. Similarly, the chert used for making lithic blades was of Baluchi origin. This shows the long-distance contacts of these people.

During Period II, while Period I type houses, bone and stone tools, copper objects and pottery continued to occur, there was a marked change in the use of white, for painting purposes—it was now much less used. However, the pottery as a whole became thick and sturdy like of which we often get in the deposits of the Mature phase.

It may also be noted that several pot-sherds bore post-firing graffiti, some of which resembled those found on the Early Indus-Sarasvatī pottery of Kot Diji and Rehman Dheri as well as Mature Indus-Sarasvatī pottery, generally taken to be characters of a regular script, for example, the V shaped sign with lateral strokes at the top and bow-and-arrow sign. The gamut of pottery had possibly some wares which resembled the 'Hakra pottery' which perhaps belonged to the same periods and was used in the Sarasvatī basin of Bahawalpur region.

The contribution of this discovery to our understanding of the very birth of the Indus-Sarasvatī Civilization is decisive—it took place indigenously, it had nothing to do with Iraq, Iran or Turan.

It has also shown that the concepts underlying the term 'Early Harappan or Indus-Sarasvatī' for the Kot Diji complex also stand modified since we have as much as 4 m of Ravi deposits. May be we have to use the term 'Early' for the Ravi Culture but since we are using the term Formative Period to denote various early fourth millennium cultures it is not at all necessary to do it.

'Hakra Culture' in Bahawalpur Region:

Some 90 odd sites explored by Mughal in the basin of the Sarasvatī in the Bikaner deserts, called Cholistan, have yielded 'Hakra' ware which is 'pre-Indus-Sarasvatī' or 'pre-Kot-Diji' type, called so because, in Cholistan the Sarasvatī is called 'Hakra'. This, therefore, belongs to the 'Formative Period' of the Indus-Sarasvatī Civilization. Thus, during the mid fourth millennium, the Sarasvatī basin was swarming with large number of settlements of the 'Formative Period' people than anywhere else.

And more importantly, not all of them came from the hills, the Hakra Ware was absolutely of local and riverine origin. It is only at a later stage that we find Kot Diji and Rehman Dheri type material entering into the Hakra settlements as at Jalilpur in upper levels, Level II. This evidence is extremely significant because it proves beyond doubt that the beginning of civilization in the Sarasvatī and the Ravi basins was not the product of the efforts of Baluchi highlanders exclusively, even though they made important and essential contributions in terms of metals and minerals without which the Indus-Sarasvatī Civilization could not have developed its known industrial development and diversification which we see from the fourth millennium BC itself at Balakot, Amri, Mehrgarh, Gumla, Harappa, Kunal, etc.

Jalilpur: Located in the old flood-plain of the river Ravi, some 70 km southwest of Harappa, Jalilpur has revealed the remains of two major phases of occupation, Period I and Period II. The levels of Period I have yielded a large number of thick underfired light-red handmade pottery with globular jars, most of which had been treated with a thick coating of mud mixed with pottery bits on the lower body. This is called 'Hakra Ware' (Fig. 31), as noted above, after the name of that portion of the river Sarasvatī which once flowed through Bahawalpur in the Cholistan deserts. The Period I level is devoid of architectural remains, except for a couple of floors made of rammed earth on lime bedding. The picture of the habitation is the same as in Level IA at Amri. The other items of culture include chert blades,

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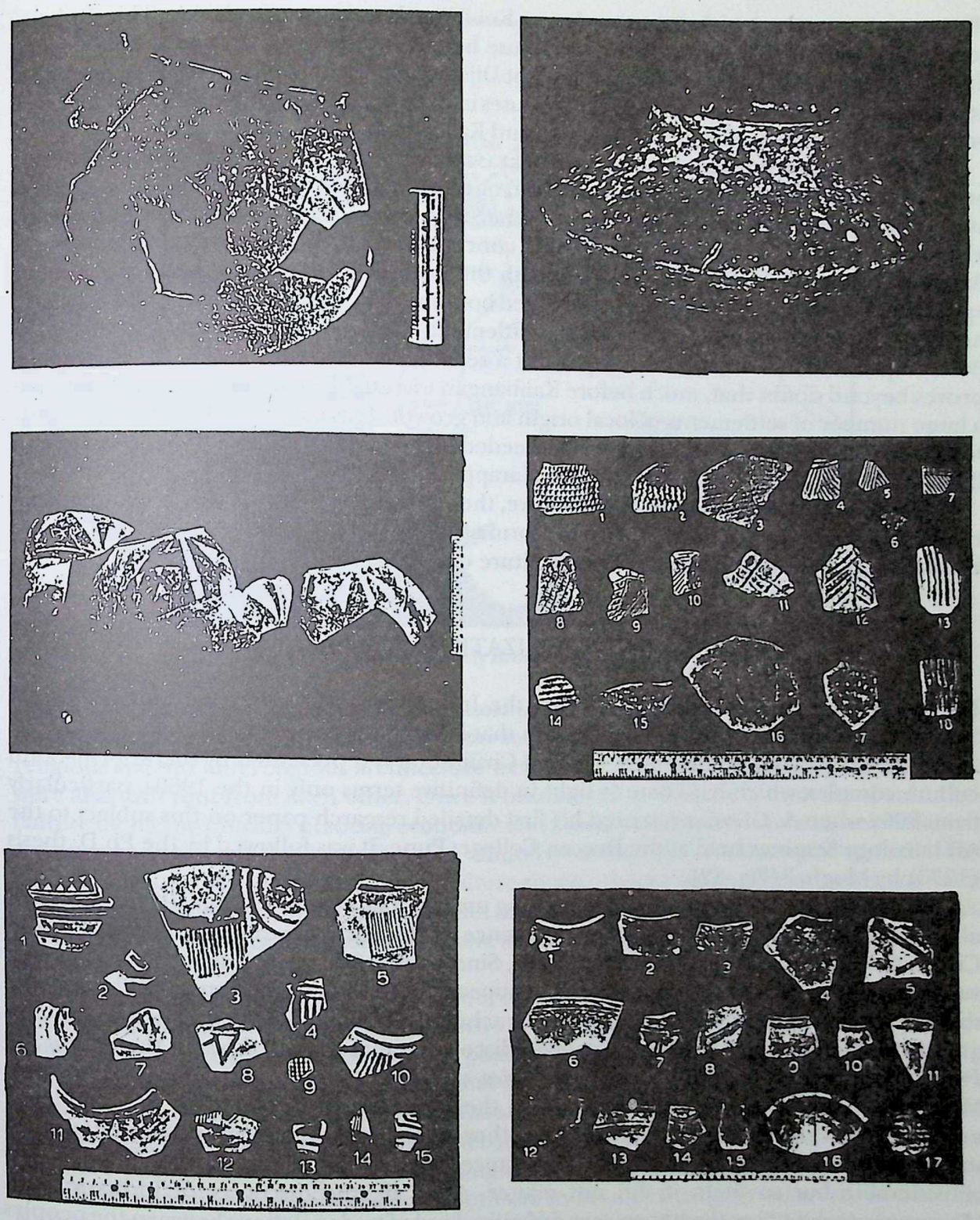

Fig.31: Hakra Ware Potteries from Cholistan.

net sinkers, bone points, clay beads, etc., indicating that it was a regular settlement of the 'Formative Phase'.

The Period II material is of the Kot Dijian type, the type we get at Kot Diji in Level I. Hence it is clear that much before the coming of the 'Early Indus-Sarasvatī' or Kot Dijians, some flood-plains of the Punjab and Rajasthan rivers were occupied by people who used in their everyday

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life a pottery-complex which was not only non-Kot-Dijian but also pre-Kot-Dijian. This the later people, the Jalilpur II people, continued to use here and elsewhere, such as at Kalibangan, alongwith a gamut of a new ware called the Kot-Dijian-Sothi Ware. Their users, thus, became a new entrant who built mud and mud-brick houses in large settlements, sometimes fortified and protected also, such as at Kot Diji, Banawali and Kalibangan.

No one knows the exact extent of the Hakra ware settlements since explorations have not been completed as yet, but two things are clear: one, that it represents a local culture-complex, and second, in all likelihood its epicentre was the Sarasvatī basin, in the old Bahawalpur region where the sites of this culture are found concentrated. It, however, extended beyond Bahawalpur. This pottery is found along with the Kot-Diji-Sothi Ware at Kalibangan in an appreciable quantity, it is pale grey with rugged bottom, absolutely distinctive. At Kalibangan, however, it did not represent a separate settlement. Still, the very fact that elsewhere, in Bahawalpur and in Punjab, it did represent a separate culture with exclusive settlements, proves beyond doubt that, much before Kalibangan was established, the Sarasvatī basin had a large number of settlements of local origin and growth. This culture is datable to the early to mid fourth millennium BC. since it is succeeded by the Kot Diji culture which is datable to 3300 BC if not earlier both at Kot Diji and Harappa.

The Hakra Culture and the Ravi Culture, therefore, formed one of the first attempts in establishing permanent settlements in the form of villages on the flood-plains of the Ravi and the Sarasvatī, the other being the Kunal culture on the Sarasvatī.

INDUS-SARASVATĪ CIVILIZATION: THE EARLY PHASE

For a very long time it was believed that the Indus-Sarasvatī Civilization had no known 'beginning' as well as 'end'. The realisation that it had both came very late.

The Early Phase of the Indus-Sarasvatī Civilization is represented by the Kot-Diji-Sothi culture complex which has come to light in definitive terms only in the 1960s, particularly from 1964 when A. Ghosh presented his first detailed research paper on this subject to the Archaeology Seminar held at the Deccan College, Pune. It was followed by the Ph.D. thesis (1970) by Mughal (Fig. 32).

One wonders as to why it took such a long time, as it did (from 1922 to 1964, almost half a century), to visualize the origin and existence of the early stages of the Indus-Sarasvatī Civilization in India itself when Baluchistan, Sindh and Afghanistan had already yielded a substantial body of evidence in its favour. It appears that Marshall, Piggott and Wheeler, the three scholars whose opinion dominated the scholarly thinking during that period, were so greatly overwhelmed by the Mesopotamian discoveries that they all thought that, if not the *People* or their culture then at least the *Idea* of 'what a city is' must have come from Mesopotamia, where cities like Ur had, in their opinion [now found to be completely mistaken] developed much earlier, although they knew that in both form and content the two sets of cities differed substantially. The distance between the Tigris and the Indus is also considerable but to them it did not matter. After all, the discovery of Indus seals in Mesopotamia did prove that there were definitive kind of trade relations between the peoples of the two lands. In their view, the traders could have brought the idea of city from Mesopotamia to India. They forgot in their enthusiasm that the physical reality, that is the formal elements of Harappa and Mohenjodaro city plans, buildings, etc., were entirely different from the physical reality of Mesopotamian cities. Where is the Mesopotamian 'ziggurat' and where is the so-called 'royal grave' with all its riches at any of the Indus-Sarasvatī cities? Where are the planned townships for the common men in Mesopotamia? Why did Cuneiform writing not at all affect Indus-Sarasvatī writing? As a matter of fact there is not a

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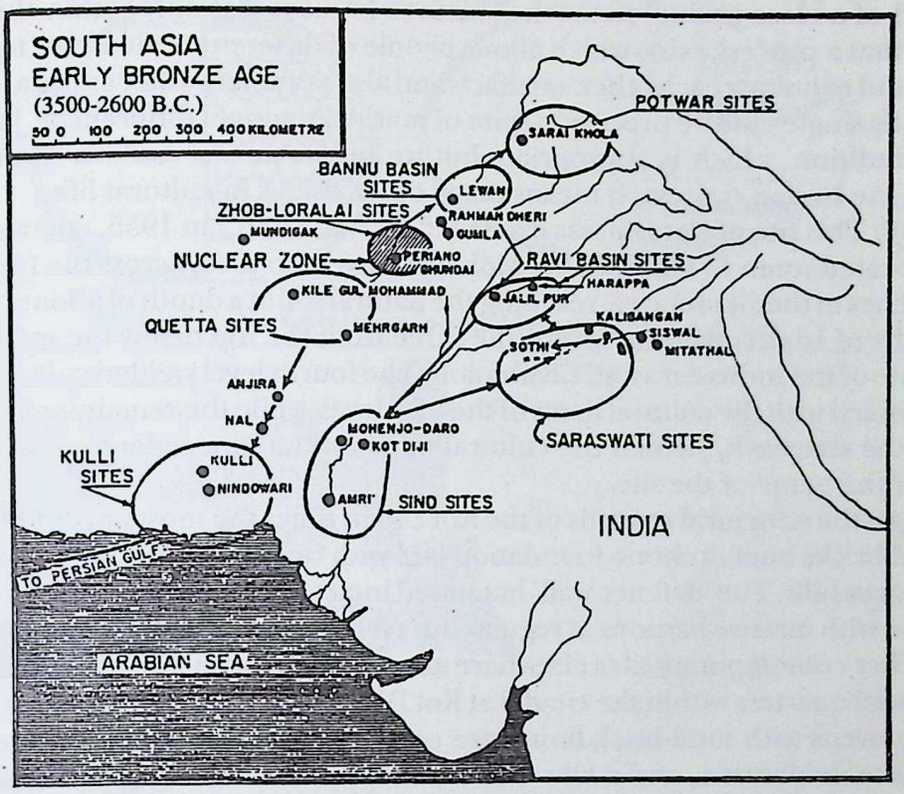

Fig.32: Map showing Early Bronze Age sites in South Asia.

single Mesopotamian Cuneiform inscription in the Indus-Sarasvatī findings. That clearly shows that the two social philosophies and socio-cultural milieu were different. The two religious systems and religious architecture were also different. Possibly, the two languages were also different from each other. Once it becomes clear that the two forms of culture—culture being the product of social, economic and moral philosophy—were so very different, any attempt to bring in the vague factor of 'stimuli from the west' is in our opinion, futile. The same applies to M. Tosi's Turanian 'culture-shock' theory since it also relies on some 'artefactual similarities', an old pastime with some archaeologists, and completely overlooks the directional changes in culture as a whole which occurred in Turan and India during the fourth and third millennia.

We can now look for indigenous sources of origin and development of the Indus-Sarasvatī Civilization. Archaeologically, such a source should have two requirements: one, an indigenous culture-complex should have placement just below that Indus-Sarasvatī cultural milieu and also 'overlapping' the latter, and second, many of its cultural and architectural traits must continue to occur in the Indus-Sarasvatī complex. The model has necessarily to be evolutionary, one developing into the other smoothly in the natural course of things. Thus, these are only the two 'stages' within a single process of 'development'. Fortunately, it is available and available at several sites in both the Indus and the Sarasvatī river-systems. This is also found in the piedmont regions of the Kirthar and the Suleiman. The type-sites are Kot Diji on the Indus in Pakistan and Sothi on the Sarasvatī in India.

Our present approach to the problem of the origins, the credit for which must go to A. Ghosh and R. Mughal, is primarily proccessual in which things develop through a very complex process of innovation, production and distribution, and not historical, which largely depends on events, i.e., suddenness of happenings. This means that all kinds of artifacts of the Mature Phase of the culture need not be present at any single site datable to the period before 2600 BC, it is enough if these are found selectively at different places, provided all of them

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formed part of a close trading network. This is so because it is only within this operational framework that a process exists which allows people of different settlements to borrow from each other and to imitate each other's artifacts and also assimilate other cultural elements into an apparently single-culture process in spite of marked regional differences. Jim Shaffer has called it 'Tradition' which is appropriate but we prefer not to use this term at this stage because, in the Indian context, it means many other things in cultural life.

Kot Diji: This site of Kot Diji was excavated by F.A. Khan[19] in 1955, and again by him in 1957. It is located some 43 km from the Mohenjodaro Bath area, across the Indus, on its left bank. Trenches in the citadel area, reaching the natural soil at a depth of about 6.5m, revealed a stratigraphy of 16 occupational layers, the three from the top below the soil belong to the Mature Phase of the Indus-Sarasvatī Civilization. The fourth level yielded cultural items of the third level mixed with the cultural items of the fifth level, while the remaining levels, from the fifth up to the sixteenth, yielded the cultural milieu of an antecedent culture, called 'Kot Dijian' after the name of the site.

Amongst the structural remains of the Kot Dijian times the most important is a Defence Wall of mud-bricks built on stone foundation laid with undressed limestone blocks brought from the nearby hills. The 'defence wall' has stayed intact up to 1.65 m height when excavated, was provided with massive bastions at regular intervals. Its constructional details are met with at several other contemporary sites elsewhere also, even in Kacch, for example at Surkotada. The residential quarters within the citadel at Kot Diji were built against the fortification wall. Community ovens with mud-brick lining are commonly found just as at Kunal, a recently discovered site in Haryana, and a kiln with a well -preserved brick-lined funnel, 107 cm in height, has come to light in one of the early levels of this culture-complex.

The pottery, which is generally wheel-turned, is very distinctive. It includes globular pots of fine thin body with short-beaded or slightly averted rim, decorated with a fugitive broad band around neck in red, brown, sepia or warm black painted on a cream or dull red wash. Slip is red, hence the surface of the pots is not too bright. Some jars are decorated with engraved concentric lines on the outside. A few have paintings of bull heads with two large horns, the in-between space being filled with six-petalled flowers (Fig. 33). This so very typical and exclusive motif, perhaps imbued with some religious or sacred significance, has been found at distant places also, such as Kalibangan and Burzahom (Fig. 34); we have already noticed its presence at Lewan. It is significant to note that some of the painted design used, like the fish-scale motif, were once considered to be exclusively 'Mature Harappan'. The other designs are geometric and they are executed in white pigment also, along with sepia and black. Besides the globular jars, so very commonly found, are heavy dishes-on-stand, thin and delicate vases with a flat base and slightly cylindrical body, bowls, shallow plates of thin grey fabric, beakers, jars, covers, lids, etc., most of which were once considered exclusively Mature Harappan. The Kot Diji pottery is indeed very distinctive, very colourful and impossible to miss. At Kalibangan, it has been found in six major varieties, designated A to F, including the Hakra fabrics or varieties with coarse base. (Fig. 35). At Kalibangan, we have the remains of several houses (Pl. II) as well as the remains of a ploughed field (Pl. III).

The objects made of stone comprised thin long chert blades and also leaf-shaped arrowheads, a type not very popular with the Mature Indus-Sarasvatī people. Terracotta objects include bangles, cakes, cones, beads and bull figurines, which were also once considered to be 'Mature Harappan'. What is important to note is that during the Mature Indus-Sarasvatī period (levels 1 to 3), all the material remains of Kot Diji levels (5 to 16) continued to occur with an admixture of some new traits, including weights, seals and writing, although all these items have now been found at Dholavira in a level or stage which is also taken as 'Transition' to Mature Indus-Sarasvatī Civilization (Stage III). Significantly, this preceded the well-known earthquake which has also marked the last phase of Kot-Diji-Sothi and

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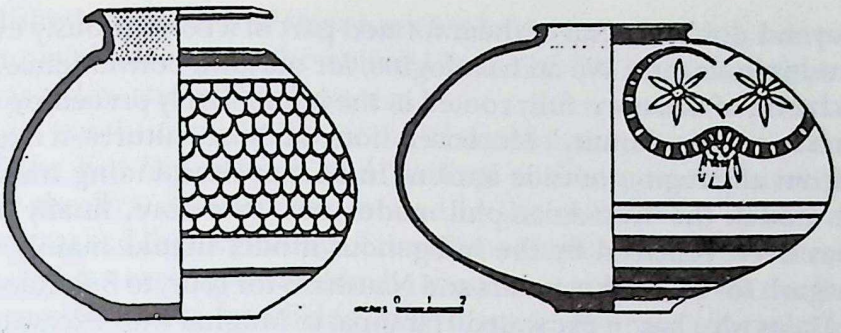

Fig.33: Kot Diji, Early Indus-Sarasvatī Pottery (after F.A.Khan).

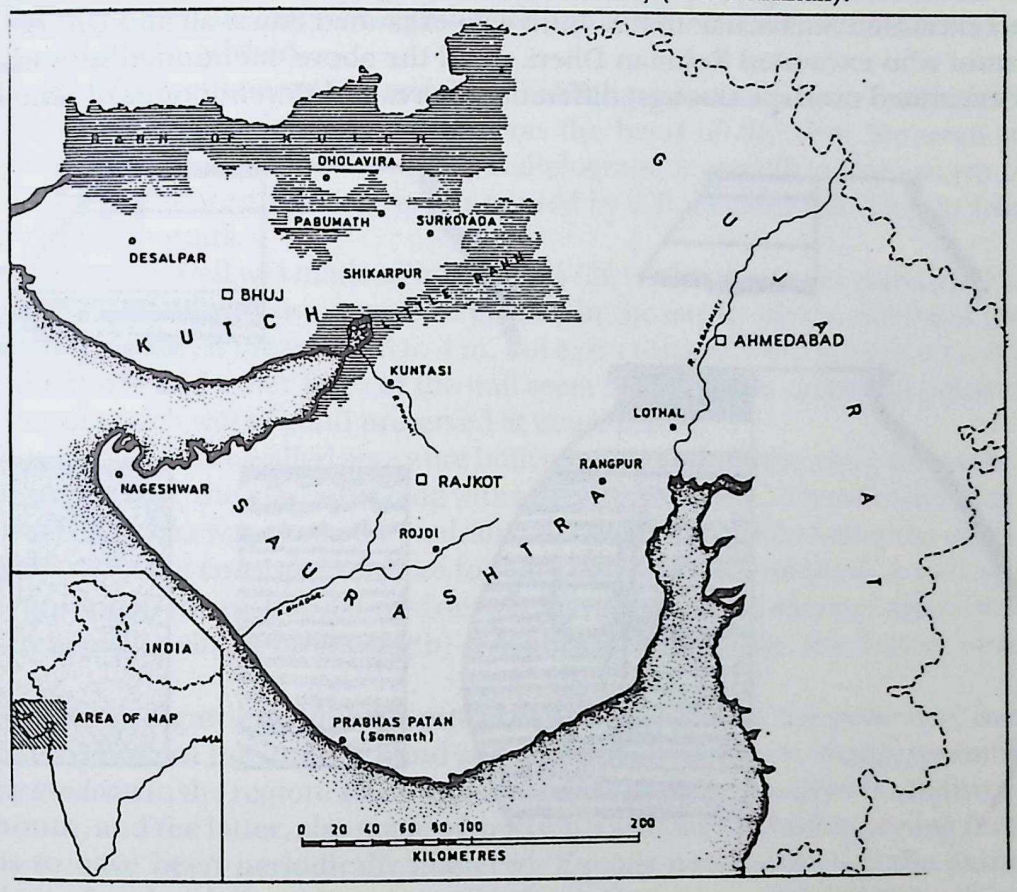

Fig.34: Kot Dijian Pot from Burzahom with bull motif.

Kalibangan I houses. We will return to this topic a little later. Now only this need be noted, that during the last phase of the Early Indus-Sarasvatī Civilization itself even those very items which were once considered as the special and exclusive gift of the Mature Phase of the Indus-Sarasvatī Civilization appeared prominently. These have been found at Dholavira for the first time but these may have been invented elsewhere in the Indus or Sarasvatī basins; we do not know exactly at this stage of our research.

Hakra Ware pots with the lower body plastered with mud, hence rugged in appearance, were in use at several places long after Hakra times (i.e., Kot Diji period). It occurred in Sindh at Amri(1) in the Taxila region at Sarai Khola(1), in Haryana at Banawali(1),etc.

There was indeed an overlap amongst all the major potteries or cultures of the third millennium north -western India although we do find new configurations of potteries and/ or cultures as we march with time: from Hakra culture to Kot Diji culture and from Kot-Diji culture to Mature Harappan or Indus-Sarasvatī culture nonetheless, there is single continuum. The phenomenon of overlap is the most significant point to note since this and this

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alone proves beyond doubt that all of them formed part of a continuously evolving culture-process, with multiple strands. We archaeologists, for our own convenience, call them new culture, but each one of these was fully rooted in the immediately preceding culture. It is an expression of 'change in continuity'. Moreover, none of these cultures, it may be noted, was even inspired from any region outside ancient India, notwithstanding trade contacts with them. The old model, the West-Asian-phil model, has, therefore, finally and completely collapsed. It has been replaced by the indigenous model thanks mainly to Jarrige who excavated Mehrgarh for fifteen long years and Nausharo for four; to S.R. Rao who excavated Lothal; to G.F. Dales who has re-excavated Harappa; to Mughal who excavated Jalilpur and explored the Cholistan region: to B.B. Lal and B.K. Thapar who excavated Kalibangan: to J.P. Joshi who excavated Surkotada: to R.S. Bisht who excavated Banawali and Dholavira and to F.A. Durrani who excavated Rehman Dheri. At all the above -mentioned sites which these scholars excavated overlaps amongst different cultures at different points of time have now

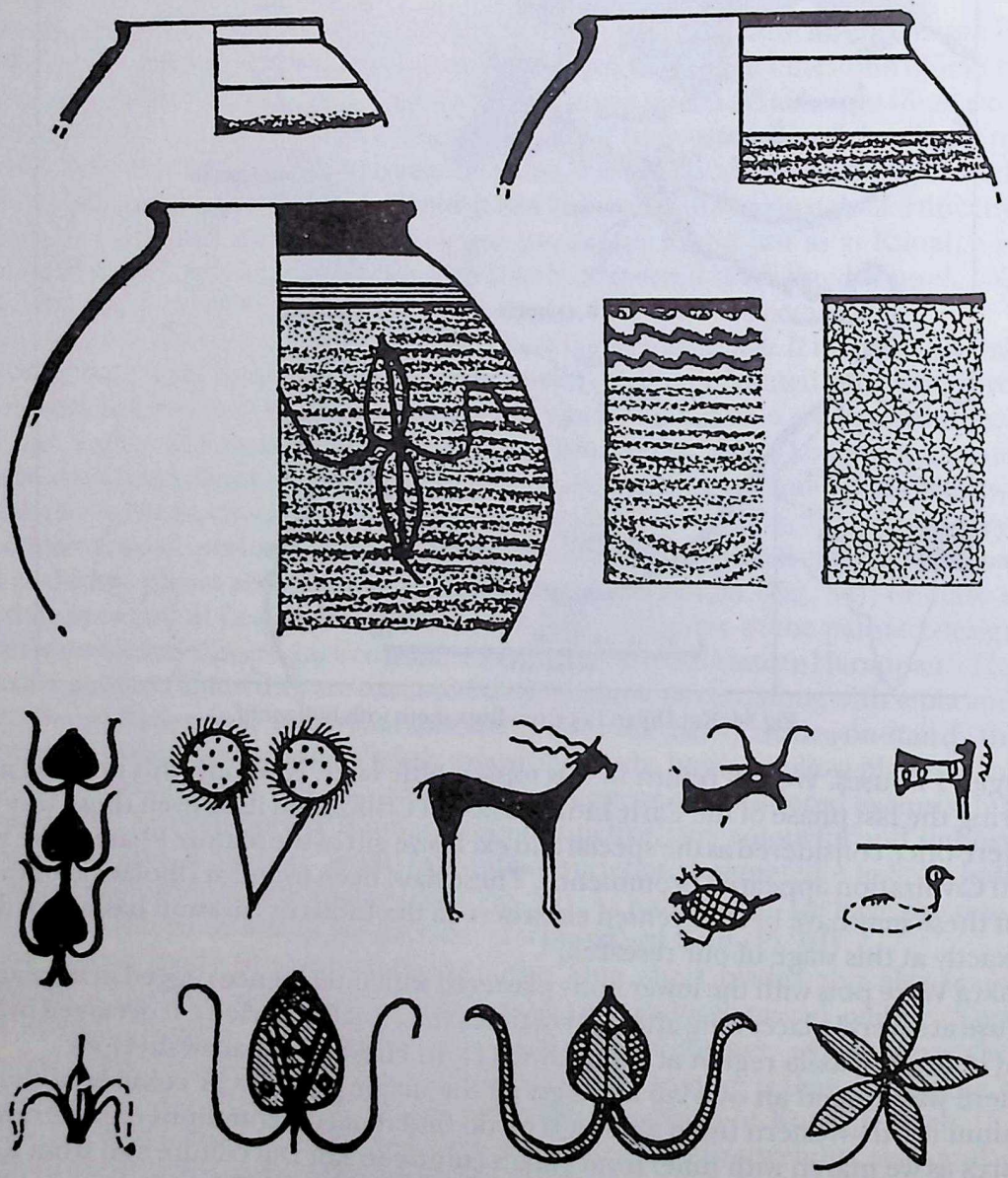

Fig.35: Kalibangan I: Painted Potteries, Fabric B.

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been fully established. Each cultural stage has been found to be evolving, hence changing, but at no stage completely dropping the cultural items of the immediately preceding stage, dropping out was a slow and gradual process.

If the 'village' was the contribution of the 'Hakra culture', the fortified township was the contribution of the Kot Diji culture, and 'writing' and 'weights and measures' were the contributions of the Transition phase located at the end period of the Kot Diji which incidentally, also marked the beginning of the Mature Indus-Sarasvatī Civilization. Wheeler, therefore, seems to have erred grossly when he wrote 'that at present, the nucleus of the Indus civilization appears to spring into being fully shaped'. No, not all. But for our artificial divisions into archaeological cultures, it was all one continuous cultural stream which flowed from the fourth millennium, nay the eighth millennium, when settlements like Mehrgarh in north-western India flourished.

Kalibangan: The settlement of Period-I of Kalibangan, belonging to the Early Phase of the Indus-Sarasvatī Civilization, was situated on the bend of the river Sarasvatī in Distt. Ganganagar of Rajasthan. It was a fortified parallelogram, some 250 m from north to south and 180 m from east to west. The site was excavated by B.B. Lal and B.K. Thapar from 1961 for a period of seven years.

The fortification wall was made of mud bricks (30 × 20 × 10 cm; proportion, 3:2:1) and in its extant portion it shows two structural phases. In the earlier phase, the basal width was 1.9 m while in the later, it measured 3 to 4 m, the extra thickness being added on the inner side. Both the inner and outer faces of the wall seem to have been originally plastered with mud, patches of which were found preserved at many places.

The houses within the walled area were built of mud bricks of the same size as those used in the fortification wall, the masonry being with alternative courses of headers and stretchers. The use of baked bricks was attested by a drain, the size of the bricks being the same as that of mud bricks. A house consisted of three to four rooms with a courtyard. A part of a 1.5 m wide lane, running in the east-west direction, was also discovered. From the width of the walls (some of them only a single brick length) it could be inferred that the houses were single storeyed.

The evidence regarding cooking practices was revealed by the presence, inside the houses, of ovens both of the underground and above-ground variety, closely resembling the present-day *tandoors* in the region. The former had mud-plastered walls with a slight overhang near the mouth, and the latter, also made of mud walls with bridged side opening for feeding fuel, seems to have been periodically plastered. Equally noteworthy was the existence of cylindrical pits, faced with lime plaster, possibly for storing drinking water. The alignment of the houses no less than the size of the bricks used was significantly different from those of the succeeding period representing the Mature Phase of the Indus-Sarasvatī Civilization.

The distinctive trait of this Early Phase, however, was the pottery which was characterized by six fabrics, labelled A, B, C, D, E and F. Of these, fabrics E and F distinguished essentially by surface colour (E for buff and F for grey), did not show marked individualities either in shape or in painted design, their main features being shared by some other fabrics. Furthermore, in frequency they were somewhat uncommon, the latter being particularly scarce.

The other finds of this Phase include small-sized blades of chalcedony and agate, sometimes serrated or backed; beads, variously of steatite (disc), shell, carnelian, terracotta and copper; bangles of copper, shell and terracotta; terracotta objects like a toy cart-wheel and a bull; quern stone with mullers; a bone point; and copper celts including a curious axe. There are around 150 copper-bronze objects in the collection indicating that metallurgy was fully established.

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The outstanding discovery, however, was a ploughed field, situated to the southeast of the settlement, outside the town wall. This is perhaps the earliest plough-field excavated so far any where in the world. It showed a grid of furrows with one set more closely spaced (about 30 cm. apart) running east-west and the other, widely spaced (about 1.90 m apart), running north-south. Of these, the former seems to have been ploughed first. This pattern bears resemblance to modern ploughing in the neighbourhood, wherein two types of crops (pulse in one direction and mustard in the other) are grown in the same field, the combination being dependent upon the size and growth behaviour of the plants. Since cultivation during this Phase seems to have depended upon flood-irrigation, supplemented by seasonal precipitation, it is reasonable to infer that only the winter crop (*rabi*) was grown, the sowing being done in the autumn after the river flood, resulting from the tropical monsoon, had subsided. Although no cereals were found in the course of excavation, cereal-type pollen has been attested in good numbers in the deposits of this period of time. (Singh, et al. 1974)

The township endured through five structural phases, rising to a height of 1.6 m above the natural soil, when it was brought to a close by a catastrophe (perhaps seismic), as evidenced by the occurrence of displaced (faulted ?) strata and subsided walls in different parts of the excavated area. Thereafter, the site seems to have been abandoned, though only temporarily, and a thin layer of sand, largely infertile and blown, accumulated over the ruins.

Subsequently, the town was re-planned and enlarged during the Mature Phase of the Indus-Sarasvatī Civilization. It was now like any other prosperous city of its time with a separate citadel and evidence of fire-worship.

Banawali: The site is located on the lost Sarasvatī in Distt. Hisar of Haryana. The single mound site is 400 m square with 10 m of total deposit, lower 3 m belonging to the Early Indus-Sarasvatī Civilization; the levels over these belonged to the Mature Phase of this civilization. It was excavated by R.S. Bisht.

In all likelihood, the Early Phase township was fortified as Kalibangan was. People used both, the burnt bricks as well as sun-dried bricks, the latter more often, in sizes like 13 × 26 × 39 cm; 12 × 24 × 36 cm, and 10 × 20 × 30 cm. The houses were mostly of one brick thickness only, hence single storeyed, although some house-walls were thicker, one-and-half, two, and even seven bricks thick. Bins, ovens, etc., on rammed earth or brick-laid floors were also encountered. Pieces of copper and copper slags were found; here was perhaps a workshop of copper metallurgy. Dull red, bright red, white-and-black painted red wares were commonly found.

Thus, the Early Phase Banawali was a small fortified township with a variety of pottery of Kalibangan I, Kunal IB and Sothi type.

The strata following it belonged to the Mature Phase with broader and larger fortification walls and houses yielding inscribed seals and sealings and typical red potteries, plain and painted. In one area, an apsidal fire temple of mud bricks was also found in which fire altars and side rooms predominated.

Rakhi Garhi: The site is located in Distt. Hissar of Haryana State. A trial trench taken by Suraj Bhan in 1966-67 had revealed a three phase sequence of the Indus-Sarasvatī Civilization at the site: the lowest was represented by the Early Harappan pottery of Banawali I type: dull red ware with paintings in black and linear decorations with incised lines; the middle level was represented by Mature Indus-Sarasvatī bright red pottery with black paintings of geometric motifs as well as flora and fauna; the upper most level had degenerate Indus-Sarasvatī pottery of Late Indus-Sarasvatī times: red ware with paintings of a different kind.

In the year 1997-98, the site has been put to fresh excavations by Amarendra Nath and P.K. Misra of the Archaeological Survey of India. Besides the upper-most level pottery of degenerate Indus-Sarasvatī, the site has so far yielded only Mature Indus-Sarasvatī pottery, a number of typical steatite seals with pictures and inscriptions, several gold, copper and bronze

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ornaments and implements, houses generally of mud-bricks but occasionally using burnt bricks, both of 1:2:4 ratio with 2:5 inch thickness, some graves, the antiquity of which is yet to be determined.

The site of Rakhi Garhi with a citadel and the lower township is very large, may be covering an area of 80 to 100 hectares, but much of it is buried below the water-table and much more is occupied by the local villagers.

THE INDUS-SARASVATĪ CIVILIZATION: THE MATURE PHASE

With this we enter into the so-called Mature Phase of the Indus-Sarasvatī Civilization about which much has been written and need not be repeated at length. We propose only to add a few new facts and describe some new sites which have come to light after Wheeler.

Mohenjodaro, Kalibangan, Lothal and other sites

Of about 1100 odd Indus-Sarasvatī sites known so far, Mohenjodaro is by far the largest; at one time believed to be spread over an area of 100 hectares, it is now believed to cover peripheral areas of 200 to 400 hectares of the suburbs. This includes recently found fragmentary brick-structures, including platforms, located by the UNESCO teams engaged in saving the site from the rising water-table at several points on the right bank of the Indus: Mohenjodaro was indeed the largest city of the Old World. Its population, on a very rough estimate, may have been upward of 40,000 people at the point of maximum growth in the twenty second century BC. Earlier the population had been estimated to be only 14,000.

The general plan to the city of Mohenjodaro is very significant because several other Indus-Sarasvatī cities are found planned roughly on the same basic principles though in details each one is found vastly different from the others. A major feature of the general plan is the division of the city into two major sections: one, the smaller section, was generally located on high ground towards the west and was, in the absence of a better term, called the 'citadel'; the second, the larger section, located on slightly lower ground was called the 'township' or respectively the 'upper town' and the 'lower town', each one apparently fortified. The upper town or the citadel part of the city contains large buildings, including those apparently meant for public utilities such as the 'granary' and 'pillared hall' and structures of a ritualistic kind, such as the Great Bath at Mohenjodaro. The lower town contains large and small houses for the people both rich and poor. These are two unit sites. At Harappa, on the other hand, there are four mounds, each one separately fortified although two of them were prominent and repeatedly published. Surkotada, Lothal, Dholavira, etc. are, however, single unit sites because the so-called citadel and the lower town do not have separate fortifications, instead, both sections are enclosed by a single outer-most fortification wall, separated only by a sub wall between the two sections, or units, generally marked by a doorway in the centre for easy communication between the two units, as at Surkotada. The two plans, however, reflect one and the same social phenomenon: the division of the population into at least two major sections; one section of the population was socially higher, to some extent exclusive, and the other was socially lower, this irrespective of whether the former denoted a ruling elite or priestly elite, or the two combined in one, and whether the latter denotes the common masses or the middle class, or the artisans and the businessmen, perhaps all in one.

At Kalibangan and Banawali the citadel had fire-altars, which were obviously for ritualistic purposes (Pl. IV). At Mohenjodaro, the citadel had the Great Bath which too may have been used for ritualistic purposes, but it also had granaries and a pillared hall perhaps, for secular purposes. The citadel of other sites have, however as yet not yielded structures of these kinds, although in most of the examples these are monumental. At Harappa, the

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granaries, etc., are located outside the citadel, indicating perhaps that these were under private control and not that of the state. At Lothal,[20] the citadel had a warehouse comparable to Harappa's granary in basic architecture. Nevertheless, the citadel of the Indus-Sarasvatī cities did have fewer and bigger dwellings than those in the lower town. For example, at Dholavira and Surkotada as also at Kalibangan, this was the situation. And this is socially significant, because it may imply that those who occupied and used these structures were the privileged ones, perhaps the rich ones also, or else they formed the ruling elite, as noted above. Here is, therefore, a very good example of archaeological remains shedding indirect light on the social set-up of the cities of the Indus Sarasvatī times. This has now been established at Harappa, Mohenjodaro, etc., where industrial areas are found concentrated in a separate sector. The same is true of Lothal. This shows that the artisans formed a separate social group which may or may not have been based upon hereditary principles, though it is most likely since transfer of technology is generally from father to son in most of the early societies. It appears that kingship in the political sense was nominal but in economic term, that is 'king as the holder of public wealth', it was dominant.

The fact of fortification is significant although in most of the small settlements, such as Allahdino, near Karachi, it is totally absent. The evidence shows that such settlements were either production-centres in metallurgy or else agricultural villages.

The massive walls of the fortifications in the cities may or may not have been used for defence against enemies; the archaeological evidence is not conclusive. Being usually situated on the banks of rivers, these may have been structures to protect the townships against floods, as has been surmised by S.R. Rao in the case of Lothal, Harappa, and Kalibangan, and several other excavators of Indus-Sarasvatī Civilization sites like Mohenjodaro. Whatever may have been the primary function of the so-called fortifications or huge surrounding walls at the Mature Indus-Sarasvatī sites, and in sites like Dholavira and Surkotada which were not located on big rivers, they could not be just anti-flood devices. Such systems existed during the early Indus-Sarasvatī phase also for example at Kot Diji and Kalibangan, where the walls were both demarcating and protecting the settlement. It is, in any case, absolutely clear that so much labour would not have been spent just for nothing. The suggestion that the walls were made as status symbols for the elite, which has been made in some quarters, appears to be a good one but is perhaps based upon weak arguments and shaky archaeological evidence. Yet it is also well-established that none of the examples at hand shows any signs of physical attack on and demolition of the fortification walls. Was then the danger of attack by enemies, though anticipated, not real?

Moreover, for purposes of defence of the townships against floods, the system was different. Against this contingency townships were established on high platforms made of mud or mud-bricks, as at Mohenjodaro. In fact, new excavations conducted at Harappa by G.F. Dales and his men are confirming what Wheeler once showed, viz., that at one point of time one sector of the major township of Harappa was also established on high mud-brick platforms. However, there were fortifications at Kalibangan, Lothal, Surkotada, Banawali, Dholavira, and possibly at Mohenjodaro as well as Harappa, besides the platforms. Thus, the presence of fortification at the Indus-Sarasvatī cities cannot be denied. What is difficult to establish is the real purpose for which it was constructed.

One may suggest that it was primarily meant for regulating the traffic of people coming from other cities as well as defence against pirates, against wild animals, and to some extent against floods also. Whatever may have been the primary objective when incorporated in town-plan of the 'Mature' phase, and even during the Kot Diji or Early phase of the Indus-Sarasvatī Civilization, military or non-military, the element of the fortification wall surrounding the entire township appears to have had already assumed multipurpose function. We have,

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however, no archaeological evidence which may be considered definitive in favour of a particular function exclusively.

The Indus-Sarasvatī civilization is marked by the emergence of some beautiful cities with sufficiently developed town-planning—whether it was the case of roads, lanes and by-lanes or private and public drainage systems, generally covered with stones or bricks as at Mohenjodaro, Lothal, (Fig. 36) Kalibangan[21] and other places. Large cities, such as Harappa and Mohenjodaro, were divided into sectors based upon professional exclusiveness, such as sectors for potters with their own kilns, sectors for coppersmiths with their own kilns, sectors for bead-makers, sectors for seal makers, and even market areas. It was indeed a great thing, and fits very well in the framework of commercial and industrial townships based upon the co-existence of different specialized industries within a single space. Still, it must be clearly borne in mind from the work done by Mughal in Cholistan that there were short-period 'industrial settlements' which may have supplied manufactured goods to the 'cites' located at some distance.

It is pleasantly surprising to note how the people honoured municipal rules over hundreds of years and did not encroach upon the roads and divert public drains in favour of their own houses. The contemporary world has not yielded any example of this kind. Neither in ancient Mesopotamia and Iran, nor even Egypt. Townships for the common people simply did not exist, what existed was only the citadel, i.e., houses for the royalty, for the noblemen and for the priests. In fact, except for Ur, Phase III, of 2000 BC when the Indus-Sarasvatī Civilization was coming to a close, nowhere was there a planned city for the middle class, and at Ur too it was only in one sector that we see signs of planning.

The Indus-Sarasvatī cities also had an excellent system of water management. The Indus, and, to some extent, the Sarasvatī, had unpredictable courses. With 10 km of its width, the

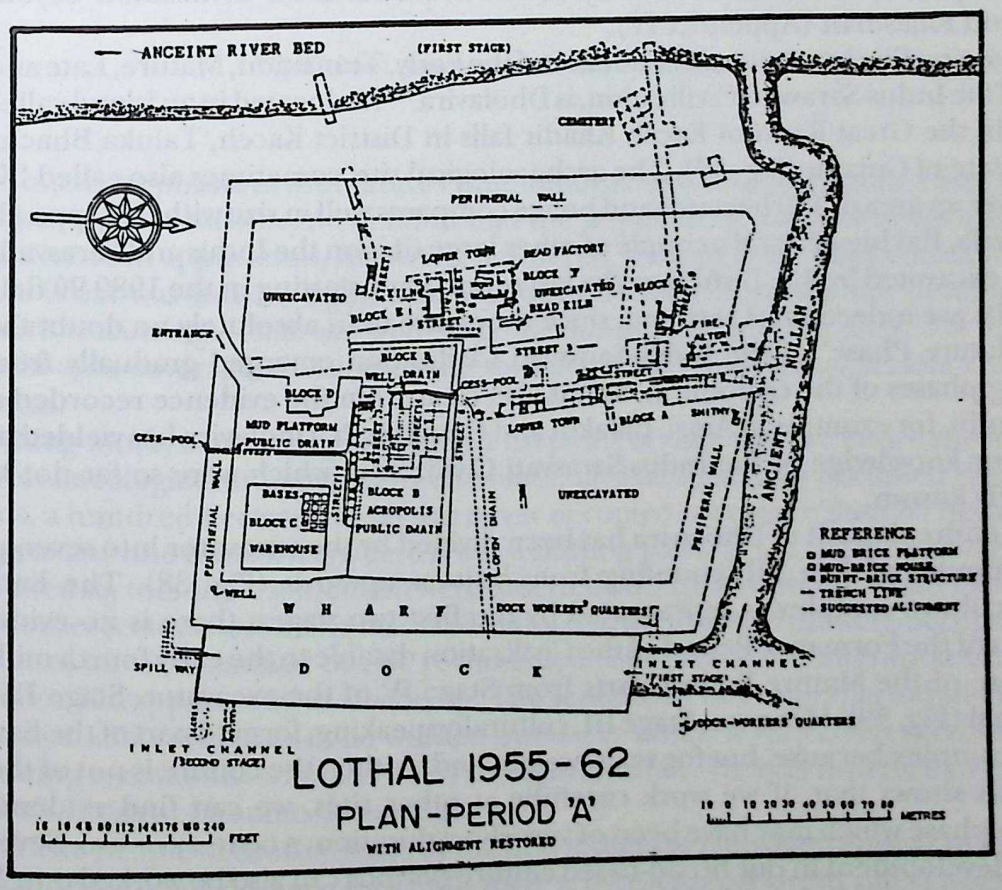

Fig.36: Lothal Plan- Period 'A'.

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Sarasvatī could shift its course 10 km away from the cities or equally it could flood the townships on its banks. The Indus is, of course, well known for shifting its course treacherously before the barrage near Sukkhar was built during the British period. It was, therefore, clear to the administration of the cities that they could not always bank upon the river to meet the water demands of the people. For this reason, the people and the administration built wells with double rings of wedge-shaped bricks at public places, near the cross-roads. (Pl. V) Individuals also built them in their own houses. Innumerable wells have indeed been found at Mohenjodaro, Kalibangan, Banawali, Harappa and other places, both within the houses and outside. At sites like Dholavira in Kacch, besides a few wells, large open spaces or rectangular tanks, the sides of some of them were cut through the rock, with structural stone bunds were created to store rain water. No other contemporary site has yielded evidence of this engineering device.

It can also be imagined that at Dholavira short and narrow canals were dug to bring water from the two nearby seasonal rivers for the fields as well as the tanks. In Lothal, an excellent example exists of making drains and diverting the water of the Bhogao river into the dockyard. The French team headed by H.P. Francfort noted similar attempts between Kantali and Sarasvatī in the vicinity of Kalibangan. Short-distance canals were definitely built to manage water for various purposes. Water-management, both in Gujarat and Sindh as well as in Rajasthan, must have been a primary concern for the people of the Indus-Sarasvatī civilization times and the archaeological evidence shows that they solved it in a variety of ways with complete success, bunding seasonal rivers in the hilly tracts to store as well as divert water, digging canals to move water into tanks, as at Dholavira and sinking wells, as at Harappa, Mohenjodaro, etc. to mention some of the common devices.

We may now turn to Gujarat for new discoveries and a fresh look at the problem of growth and development as well as continuity of the Indus-Sarasvatī Civilization beyond Sindh, Punjab and Rajasthan (Appendix IV).

Dholavira: The latest site with evidence of the Early, Transition, Mature, Late and Decline phases of the Indus-Sarasvatī Civilization, is Dholavira.[22] It is located in an island called Khadir, situated in the Great Rann of Kacch Khadir falls in District Kacch, Taluka Bhachau of the present state of Gujarat (Fig. 37). The archaeological site, sometimes also called 'Kotada', is spread over an area of 100 hectares and hence compares well in size with Harappa (150 hec.), Ganveriwala, Rakhigarhi and a couple of other large sites on the Indus and Sarasvatī. The site has been excavated by R.S. Bisht over the last seven years, starting in the 1989-90 field season. The results are indeed most startling, since they leave us in absolutely no doubt that the so-called 'Mature Phase' of the Indus-Sarasvatī Civilization emerged gradually from several preceding phases of the civilization, as was also clear from the evidence recorded at several sites in Sindh, for example at Amri, Balakot and Ghazi Shah. Dholavira has yielded many new facts to our knowledge of the Indus-Sarasvatī Civilization which were so far not known or imperfectly known.

The entire deposit of Dholavira has been divided by the excavator into seven phases or 'stages', numbered I to VII, counting from bottom upwards (Fig. 38). The Early Indus-Sarasvatī culture-complex is represented by the first two stages; there is no evidence of a settlement of the Formative Period of the Civilization datable to the early fourth millennium. The culture of the Mature Period starts from Stage IV of the excavator. Stage III is called Transitional (Fig. 39). However, Stage III, culturally speaking, formed part of the Early Indus-Sarasvatī complex because, but for seals, weight and writing, the culture is not of the Mature Phase. This shows that, if we work carefully at other sites, we can find evidence of the Transition phase which may have been of very short duration, a century or two. Several other phases of development in our broad-based culture-periods can also be worked out. The logic of culture-dynamics clearly supports this. At Harappa also Dales has successfully shown it; he

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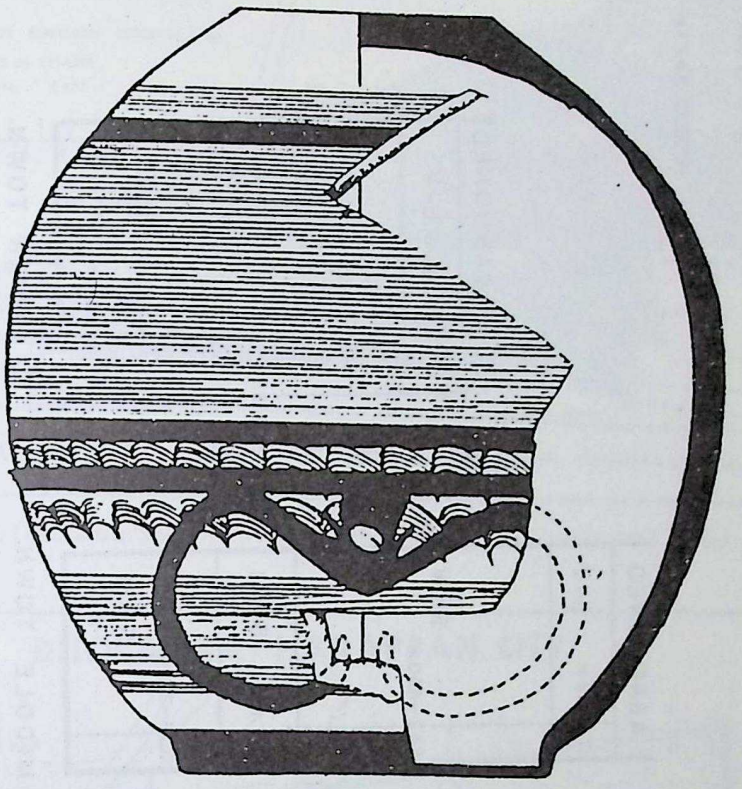

Fig.37: Map showing location of Dholavira.

has worked out three phases in the Mature Phase deposits and two phases in the Late Harappa. It must, however, be clearly borne in mind that the sequence of stages of development can never be universal in application, site to site it differed, though there was a constant pattern in changes. What was indeed significant was the direction in which the developmental changes were occurring. That was generally the same as at the city sites. For example, expansion in area coverage, division of the township into professional sectors and public utility services.

One thing more, and very significant. At no point of time was the entire site as known to us from archaeological mounds at any one place, say Harappa, fully occupied (Fig. 40). In other words, a hundred hectare site say was never occupied over more than 80 hectares may be even less at any one time. Everywhere it was a shifting pattern, i.e., at some points of time some inhabited sectors of the settlement were deserted only to be reoccupied after some time, while some other sectors were being deserted. Similarly, when new areas were occupied, some of the old ones were re-planned or else re-modelled. The fact of this alteration is now fully established for Harappa as well as Dholavira. The settlement of a multi-period site is indeed a very complex affair and cannot be worked out easily unless a very concentrated effort is made, planning excavations is indeed a very thoughtful affair. We may now turn to the details of Dholavira's history of human occupation.

Stage I: The people of the first stage or the first settlers of Dholavira appear to have come into the island from outside since they built their settlements on virgin soil. They occupied a large area, somewhat flat, like a terrace, but it was a rocky terrain with an undulating surface.

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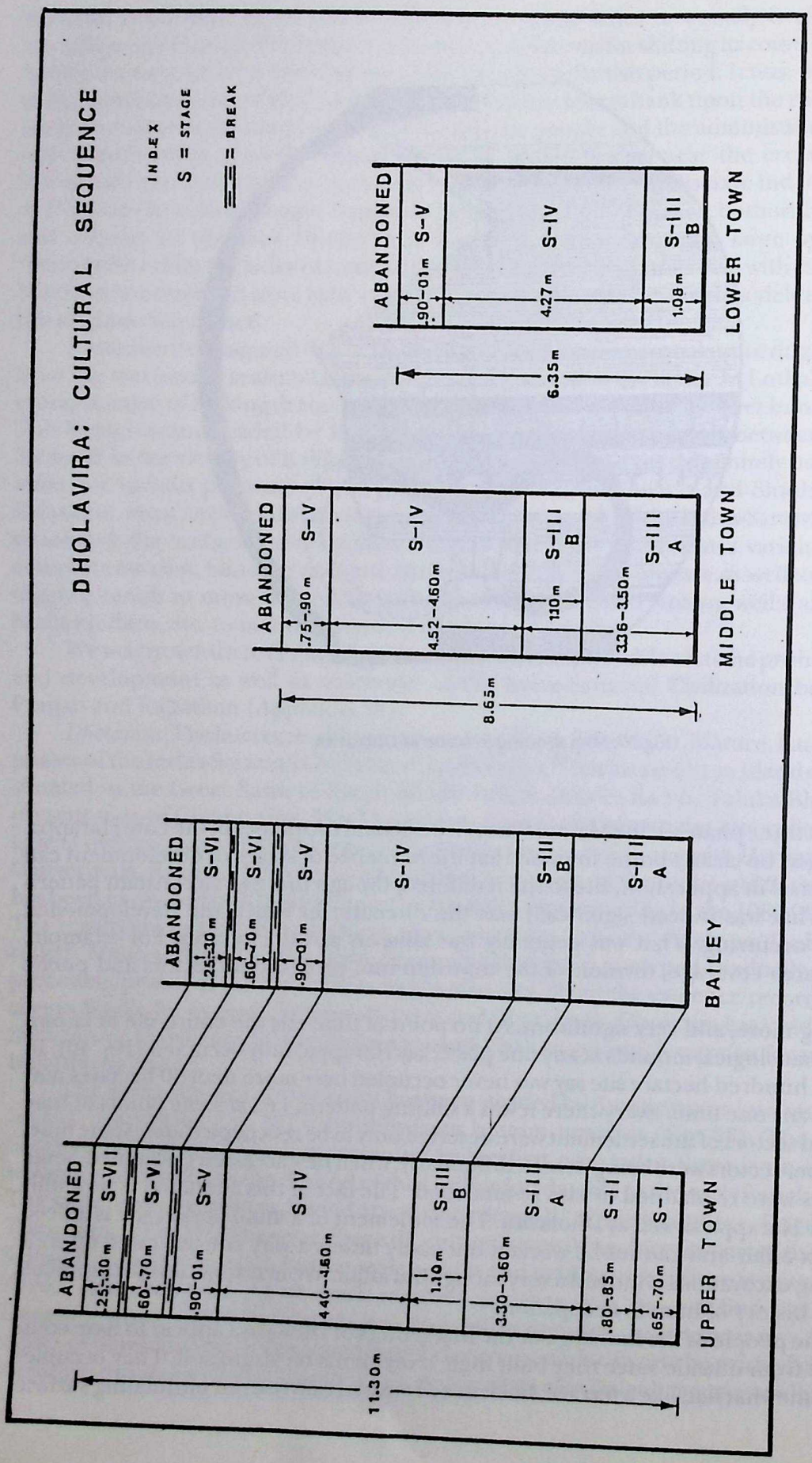

Fig.38: Dholavira: cultural sequence.

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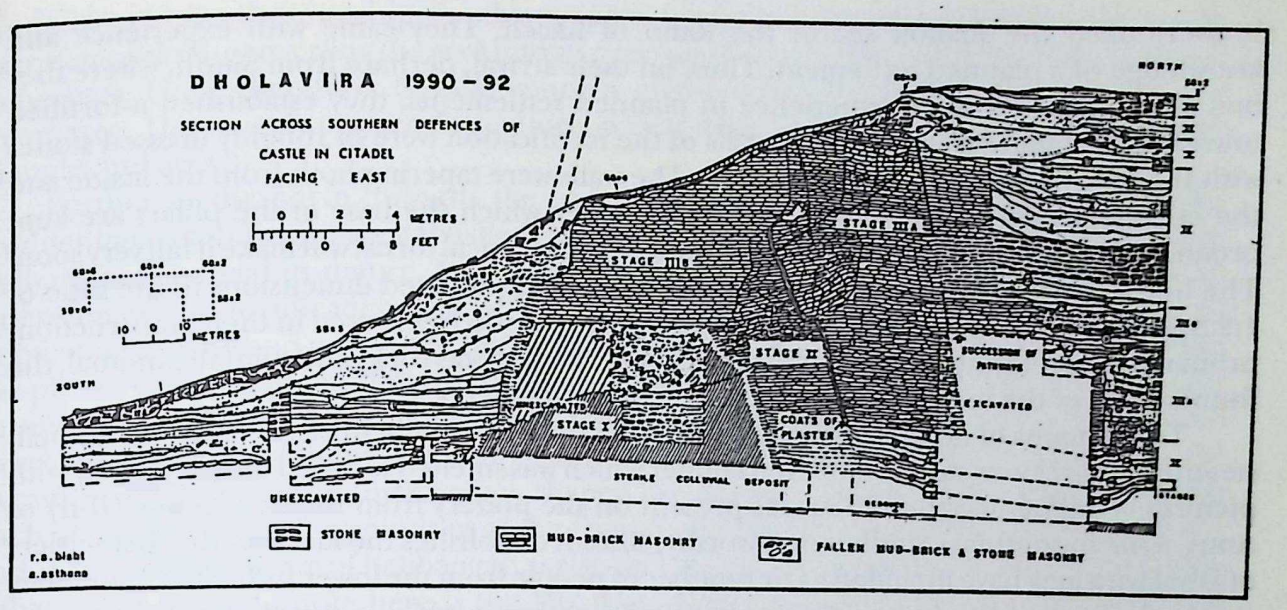

Fig.39: Dholavira: Section Across Southen Defences of castles in Citadel.

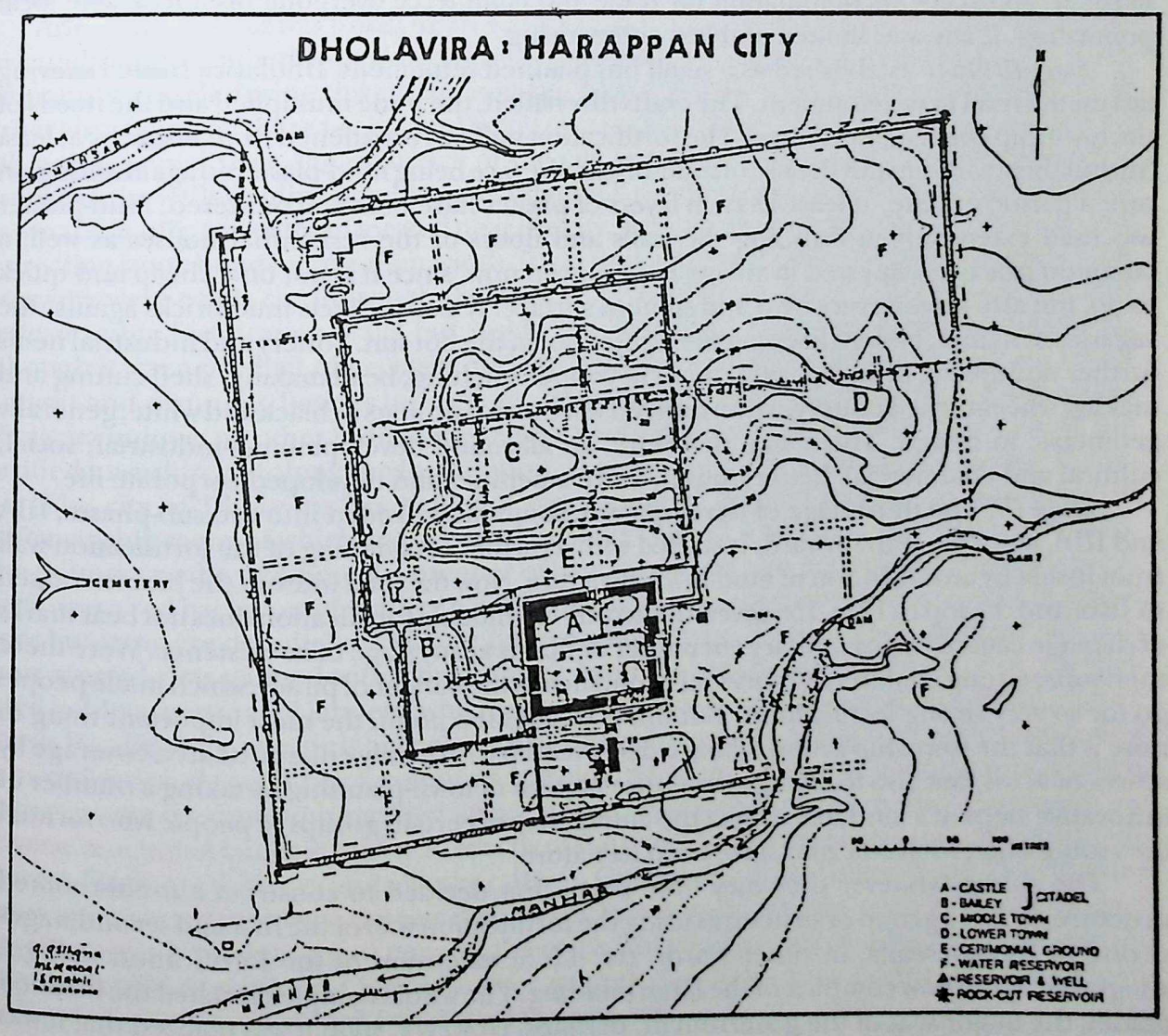

Fig.40: Dholavira: Site Plan.

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It overlooked the shallow sea of the Rann of Kacch. They came with experience and knowledge of a planned settlement. Thus, on their arrival, perhaps from Sindh, where they had already gained some experience in planned settlements, they established a fortified township, rectangular in plan. The walls of the fortification were of roughly dressed stones with the base of the wall as broad as 11 m. The walls were tapering both from the inside and the outside, based upon the same principle under which the base of the pillars are kept broader than the top of the shaft, if this is not done the vertical thrust will make it fall very soon. The houses were built largely with moulded mud-bricks of fixed dimensions in the ratio of 1:2:3 for perfection in architecture, although stone too was freely used in their construction, primarily for achieving strength at the base. Since the area was rocky and rainfall minimal, the foundations of the houses were not required to be too deep.

The remains of objects of everyday use from the site include works of crafts using shell, steatite, semi-recious stones, and even copper which was smelted locally. Painted pottery with pictures recalling designs and motifs present on the pottery from the early levels (II-B) of Amri, a site in southern Sindh is noteworthy, since it establishes the fact that the first settlers of Dholavira may have included a fair number of people from the lower Indus basin. In other words, the birth of Dholavira lies in a historical situation in which a group of people decides to go and settle down in an area which was rich in minerals, a variety of stones and had a natural harbour, an excellent combination for trade and commerce over long distances. The local population, if any, was limited and less enterprising.

Stage II: Once established as a small but planned settlement, Dholavira started moving fast on the road to development. The crafts diversified, the trade multiplied and the needs of the township consumer oriented. The fortification wall was broadened from inside by at least 3 m but this was done with the use of mud-bricks, the face being mud-plastered again and again over a period of time, at least 13 such layers of plaster have been encountered. Mud-plaster was used extensively in finishing the walls and floors of the residential houses as well, a common practice witnessed in village houses even now, since it is not only cheap and quick to do, but also leaves a very neat and smooth surface. It also protects mud-bricks against the vagaries of nature, besides keeping the house cool in the hot sun. Pottery and industrial items further multiplied, bringing refinement in copper smelting, bead making, shell cutting and making wheel-turned pottery, a thin dull red ware with paintings in black and white, generally geometric in design. There was, therefore, an all-round development—industrial, social, cultural and commercial: better houses, more amenities and developed corporate life.

Stage III: The third stage of development, sometimes divided into two sub-phases, IIIA and IIIB, was a big leap forward. It started with a further broadening of the fortification wall from inside by around 4.5 m of mud-brick structure. Now the total width at the base increased to 18 m and the top to 12 m. However, this so very formidable fortification does not bear marks of damage caused by any military encounter or floods at any stage of its existence. Were there then some strong commercial consideration, such as the danger of piracy, which made people go for so very strong fortification? But this is besides the point, the most important thing to note is that the township found taking a decisive step to not only enlarge its area-coverage by scores of acres, but also to change the entire pattern of town-planning by taking a number of innovative steps of a kind that reflect the emergence of certain groups of people who formed the ruling elite, whatever may have been its nature.

The rulers, whoever they may have been, now decided to construct a multi-roomed structure, in fact a group of structures using the fortification wall of the first and second stages as one of its own walls. In other words, the 4.5 m extension of the fortification wall got integrated in the new complex of the large building. The whole complex is called the fortified citadel, the major seat of the government, perhaps. However, soon it was realized that it was not enough. It would not meet the growing needs of the settlement. It was now thought

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prudent to re-plan the township. For this purpose, a number of houses, located on the north, were demolished, converting the area into an open-air theatre, perhaps for social and cultural gatherings. Here, therefore, lies the concern of the rulers for things beyond trade and commerce. Here we find place for culture, which deals with the finer aspects of human thought and activity.

Further to the north, towards the east, a modest but important structure-complex (residential-cum-office) was established, presumably for the second line of administration, perhaps commercial in nature. It is separately fortified but the fortification was only an extension of the fortification wall of the citadel. This is expansion. It means growth in population, wealth and power. On the east and the west, the residential area of the common people were also enlarged. This presupposes population growth and its demands. A larger fortification wall was built to encompass the so-called citadel, administrative blocks and township, or Upper, Middle and Lower townships, respectively, in the terminology of the excavator. This outermost fortification, shaped like a rough rhomb, had four gates, one on each of the four sides. It reminds us of the rhomb which characterized the plan of the Early Indus-Sarasvatī township of Kalibangan as also the general plan of the AB Mound of Harappa. What is important to note here is the fact that planned township which had so far been considered to be a feature of the Mature Phase in Sindh and Punjab has turned out to be of the Early Phase even in Gujarat.

Apparently all this was usual; many other Gujarat settlements of this civilization, such as Surkotada exhibit, broadly speaking, this very planning. But where Dholavira seems to have distinguished itself during this phase, is in the Water Management system, as briefly noted earlier also. Being on the sea-coast, and being on a rocky flatland, being located in an arid land with no perennial river, the existence of the city had to be supported by large fresh-water reservoirs, the wells yielding potable water being still very few in the island. The unpredictable seasonal run-offs, two of them located near the city, were thus tamed and their water collected by erecting stone bunds across their width. It was then diverted inside the township where the reservoirs were partly cut thorough the rock and partly constructed along the eastern and western outer fortification walls but inside the township. It was no mean achievement, although it was a product of necessity and the compulsions of the terrain. It involved much thought and planning, besides technology. It was indeed an exclusive feature which makes Dholavira unique; no other Indus-Sarasvatī site planned a series of water reservoirs within the fortified township and along the fortification, in either the Early Phase or the Mature Phase.

The city of Dholavira has yielded a vast variety of cultural items, the excellence in craftsmanship many of which was achieved in Stage II itself; it was later only further refined. The pottery saw the addition of a number of new forms and also decorative designs done in black over a red background, washed as well as slipped. Many of them are Amri and Kot Dijian types but some are definitely of Mature Indus-Sarasvatī type. They include globular jars with short averted rims painted with a broad black band, S-shaped jars of medium size, parallel-sided goblets, perforated jars, etc. which were once considered the hall-marks of the Mature Phase. Significantly, one fairly big potsherd bears two fragmentary characters of known Indus-Sarasvatī script, done in black colour as at Rojdi in Gujarat. Equally, perhaps much more, important are the three uninscribled square steatite seals with pictorial representations on the obverse and holed knobs at the back, exactly of the type found in the habitational levels of the Mature Phase at Dholavira and all other sites in Gujarat, Sindh and elsewhere. One of them bears a picture very similar to the so-called 'Seven Priests and Sacrifice' found at Mohenjodaro decades ago, with only one part missing, the picture of seven priests standing in a line wearing 'caps with tails' is not there. One of them bears the well-known 'One Body with Three Heads of Ibex' picture found at Mohenjodaro, Harappa, etc.

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Here we have, therefore, in the context of the Transition from the Early Indus-Sarasvatī to the Mature Indus-Sarasvatī, the imagery as well as the writing, both of which characterized, in the popular opinion, the Mature Phase of the Indus-Sarasvatī Civilization. The evidence is clear and convincing though in the Mature Phase these items understandably proliferated and their workmanship improved to perfection. Thus, it cannot now be said that these two major items of the Mature Phase did not have an earlier beginning. That is precisely the reason State III of Dholavira is called 'Transitional Phase' of which we have several examples.

It may further be noted that there is also a cubical chert weight in the collection of this stage, an item which clearly indicated that the systems of weights and measures which were then generally attributed to the Mature Phase, had started in the period prior to the Mature Phase, in the 'Transition Phase' at Dholavira, to be exact.

Though not conclusively proven, it is possible to visualize in the light of this evidence that the origin of some very important items of the Indus-Sarasvatī Civilization emerged outside the Indus and Sarasvatī basins.

When the total assemblage of Dholavira's Early Phase, is seen in the light of the Kot Diji findings of the Early Indus-Sarasvatī Civilization, where seals, writing and weights were absent but many other features of the Mature Phase of the civilization were available, such as the terracotta cakes, perforated jars, *pipal* leaf decoration, the use of the standard bricks, etc. besides, of course, the planned township, as found at Kalibangan, Kot Diji, etc., things start falling in their rightful positions. Now hardly any other significant item of the Mature Phase of the Indus-Sarasvatī Civilization, except the writing system, remains to be found in the levels which were definitely of the pre-Mature Phase. This is, therefore, rightly called the Transitional phase.

This is vital, extremely vital for our understanding of the basic nature of development and the directional changes in the course of the entire Indus-Sarasvatī Civilization. So far we have been dividing the entire course of the civilization into a framework neatly divided into three separate compartments: Early, Mature and Late, as if we can demarcate them precisely in water-tight compartments and define them in no unambiguous terms. The tragedy with us has been that this system was also seen in the framework of 'evolution', at least in some quarters, a term with some justification in the biological sciences but of doubtful application in the field of civilization which is exclusively human. Possibly the model of 'change-in-continuity' explains this situation much better. Then there is a clear admission of the fact that the change is from *within* the process as responses to challenges posed by developing economies and that it has not been brought about by the factors *outside* the process. In this model, terms like 'ideas have wings' (Wheeler) and 'culture-shock' (Tosi) become meaningless because they presuppose that in the origin of new elements of the Indus-Sarasvatī Civilization lie predominantly external factors, Mesopotamian for Wheeler and Turanian for Tosi.

Stage III had a long duration, around 300 years, which is substantial and allows enough time for the growth of the civilization to the extent it developed, with a strong network of internal trade and commerce, encompassing settlements established from Mehrgarh to Kalibangan and beyond towards the east, Harappa to Lothal and beyond, towards the south-west.

It is common knowledge that no culture can ever hope to enter into trade ventures across the difficult seas and mountains, as the Indus-Sarasvatī did, unless and until it has developed its own centres of specialized crafts, its own system of routes linking these centres, and its own system of valuation of goods meant for exchange through several hands, and also in several stages perhaps. And it is also common knowledge that seals, sealings, weights, measures, writing, etc. are the concomitant elements of fast-developing commercial ventures. We, therefore, find at Dholavira a situation which is perfectly in the fitness of things—the

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introduction of writing, seals and weights were the features of a convincingly developing economy based upon an expanding network of trade and commerce, poised to create necessary spring-board to launch long-distance overseas trade.

The expansion in trade is perhaps also reflected in the fast growth of the city in terms of new structures for specialized use and better amenities, well-laid walls of the water reservoirs, maintenance of gateways, etc. However, at the fag end of this stage, a severe earthquake occurred which cracked and crumbled a number of buildings, the clear evidence of which has been recorded in several buildings at the citadel or the 'Upper Township', as the excavator has named it. The residential quarters of the common people too tell us the same story—tilted walls, sagged walls and cracked walls, coupled with undulating surfaces. However, by this time the township had already developed such a high degree of administrative experience, technological skills and economic stability that the structures needing repairs were repaired and structures which needed re-building were rebuilt. Not only that, it was felt necessary to add a new large sector to the township, towards the east. As if in order to bring even this new township into the existing orbit, the existing fortification wall was extended towards the east.

Thus, by the end of Stage III, the city of Dholavira had developed three distinct sectors in the vast settlement. These have been called Upper Town, Middle Town and Lower Town. Between the Upper and the Lower townships stood the open space called Rangabhumi by the excavator for he feels, as noted earlier, that this area served the purpose of open-air theatre for cultural programmes, although like the Ramalila Maidan in Delhi, it may have been used for socio-political gatherings as well.

The three townships of the city of Dholavira, according to the excavator, represent the well-known Ṛgvedic *trimeśṭhin* system. The *Ṛgveda* makes mention of *Parama-veśṭhina* (Upper Township), *Madhyama-veśṭhina* (middle township) and *Avama-veśṭhina* (lower township) respectively for the people who belong to one township of the city or another. It makes perfect sense.

Stage IV: This is the stage of full-fledged and developed urban manifestation of the Indus-Sarasvatī Civilization. It is marked by highly sophisticated and systematic town planning (Fig. 41), with extremely useful drainage devices as well as widespread use of writing, found present not only on seals and sealings but also on objects of everyday use. A unique inscription of ten

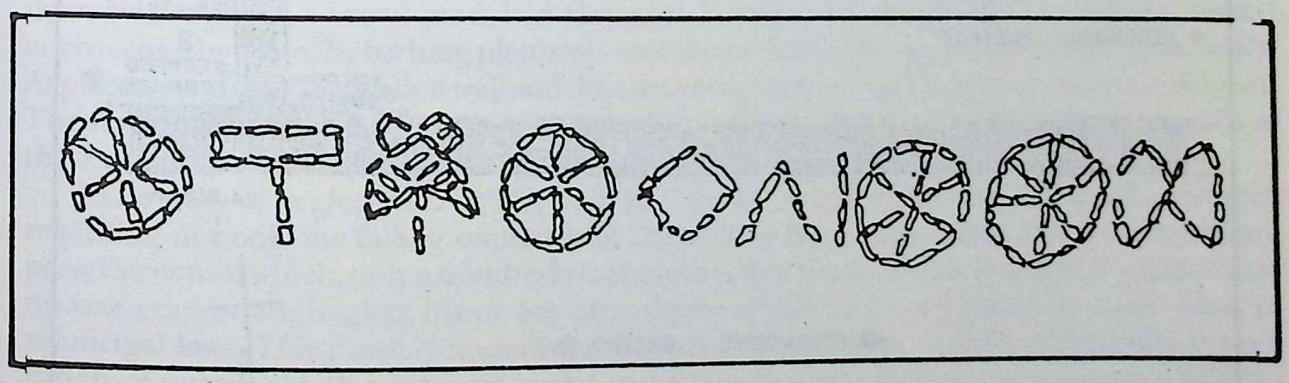

Fig.41: Dholavira: Signboard with ten characters.

characters, each more than nineteen inches or nearly 30 cm in height, made out with the help of pieces of milk-white faience or glazed steatite fixed in grooves made on a long wooden board was discovered at the site. It was apparently hanging on the lintel of the huge doorway near the northern gateway. It was, however, found fallen flat on the ground over debris (Fig. 42). Never before had such a signboard been found in an Indus-Sarasvatī township, the fact which underlines the importance, perhaps commercial, of not only the structure which bore it but also the site as a whole which was located on the shores of the shallow sea of the Rann,

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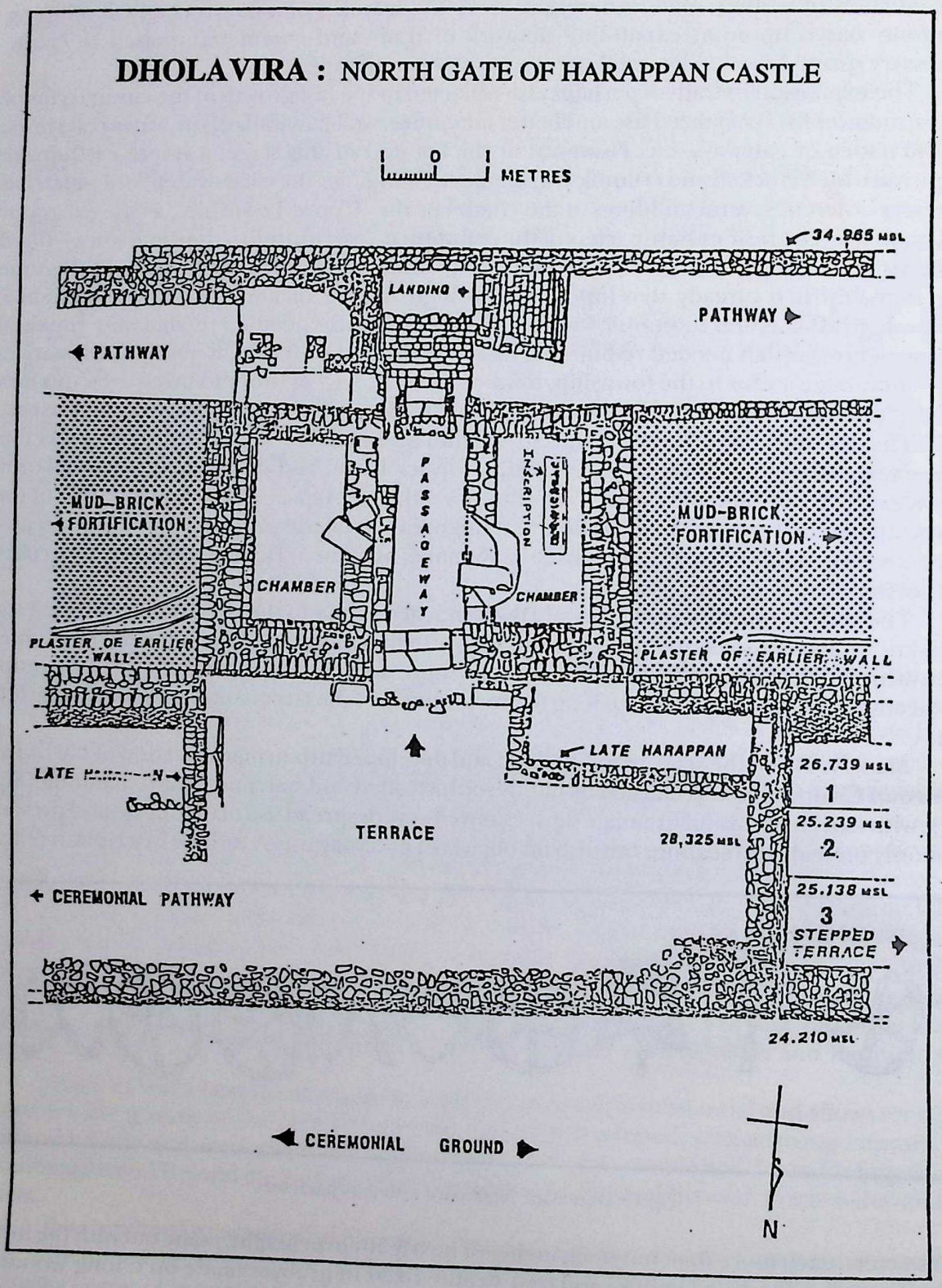

Fig.42: Dholavira: North Gate of the Castle.

perfectly suited for the seasonal shipping using small boats. It may be noted that what is today a body of slushy water, often with a dry crest hindering movement by boat, was very different 5000 years ago. The silt layer was then not so thick and water, an extension of the Arabian Sea,

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was deep enough, at least in channels, possibly deeper by six to eight metres, to allow small ships to move along certain channels.

Other objects found at this level include works of exquisite craftsmanship in terracotta, bone, stone, metal, etc. The terracotta figurines include some representing human males and females, and also animals, usually cattle. Shell objects generally include bangles. The copper implements, including arrow heads, celts, knives, etc. are of the classical types found at Harappa, Mohenjodaro, Kalibangan, Banawali and Lothal. This is also true of the beads of carnelian, agate, jasper, steatite, etc. Ear, nose and hair ornaments of faience, ivory objects, and gold and silver jewellery found here are also of Mature phase types. A large number of terracotta figurines have been found together at one place 'as if these were discarded once the religious ceremonies connected with cults associated with them were over'.

The excellence that was reached by the architectural craftsmen at Dholavira was not matched at other places in Gujarat. At Mohenjodaro a few large rectangular and round stones, well ground as well as superbly smoothened, were found but rarely understood as architectural pieces. At Dholavira we are left in no doubt that such plain and holed stones were used in the building of structures, particularly pillars with capitals though the majority of them were found in contexts different from the original simply because these were pulled down and re-used in the buildings of the later phases, such as the one near a bead-making factory. There are some examples of highly smoothened or 'polished' stone pillars, four to six feet in height, with tops looking like a mushroom which the excavator found standing amidst large buildings near the eastern fortification wall. These are not representations of the phallic symbol as some people once felt; the excavator feels that these were built purely for decorative purposes, a practice which the Greeks adopted some 2500 years later. But this is not proven.

Stage V: The fifth stage represents the inevitable, gradual decline in civic standards. Even the upper township or citadel shows encroachments made by house-builders; the roads, including the main ones, also show signs of such attempts. The repairs made in the walls of the citadel also show indifferent workmanship, using indifferently worked stones fitted in an uneven manner. A wall on the Eastern Gateway (Fig. 43), when it started leaning inward, rather precariously, the authorities, instead of rebuilding it, just gave it a support, with awkwardly constructed buttress walls, which not only distorted the symmetry of the buildings but also narrowed the width of the road to the extent that now hardly a single man can pass through. Similarly, a broad road, laid along the fortification wall in the citadel, was found encroached by a kiln, by bathing platforms and also by extra rooms constructed haphazardly. At places, even the fortification wall and the bastion towers were allowed to be narrowed down. The story was the same even in the Middle and Lower townships—people robbed the walls of their stones and bricks in a sector of houses which was deserted.

The story of neglect in civic life, both in the citadel and the township, speaks volumes regarding not only the falling standards in the civic administration but also the crumbling power structure which, only a hundred years earlier, had been so very strong and vigilant that no one could dare neglect his or her civic duties which were regulated by some kind of municipal laws. This possibly underlines the fact that a decline of this kind results from a variety of causes, chiefly economic, social and political, which lead to governmental failures spread over several decades and generations.

The decline in civic administration is, of course, reflected neither in the form of earthen pots and pans nor in the painted decorations over them because it was too low a social stratum which produced them to be directly affected by the decline in the governmental system. The seals and sealings registered some significant changes, particularly in the pictorial representations, sometimes even in their complete loss. Lapidary also registered some decline and also metal craftsmanship.

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The process of 'change towards decline' seems to have started some time around 1900 BC and continued through two or three centuries. Apparently the decline here was a slow process in which orderliness crumbled, new systems emerged which sometimes replaced the old ones. It represents qualitative change in the standards of life—social, cultural and economic. Decline was not at all change in the culture-form. Trade still formed part of the corporate life. Inscribed seals were still in use. It may be noted that the same was true of the latest phase township of Mohenjodaro where houses were built right on the old public buildings such as the Great Bath. Harappa was also no exception—the Cemetery 'H' houses

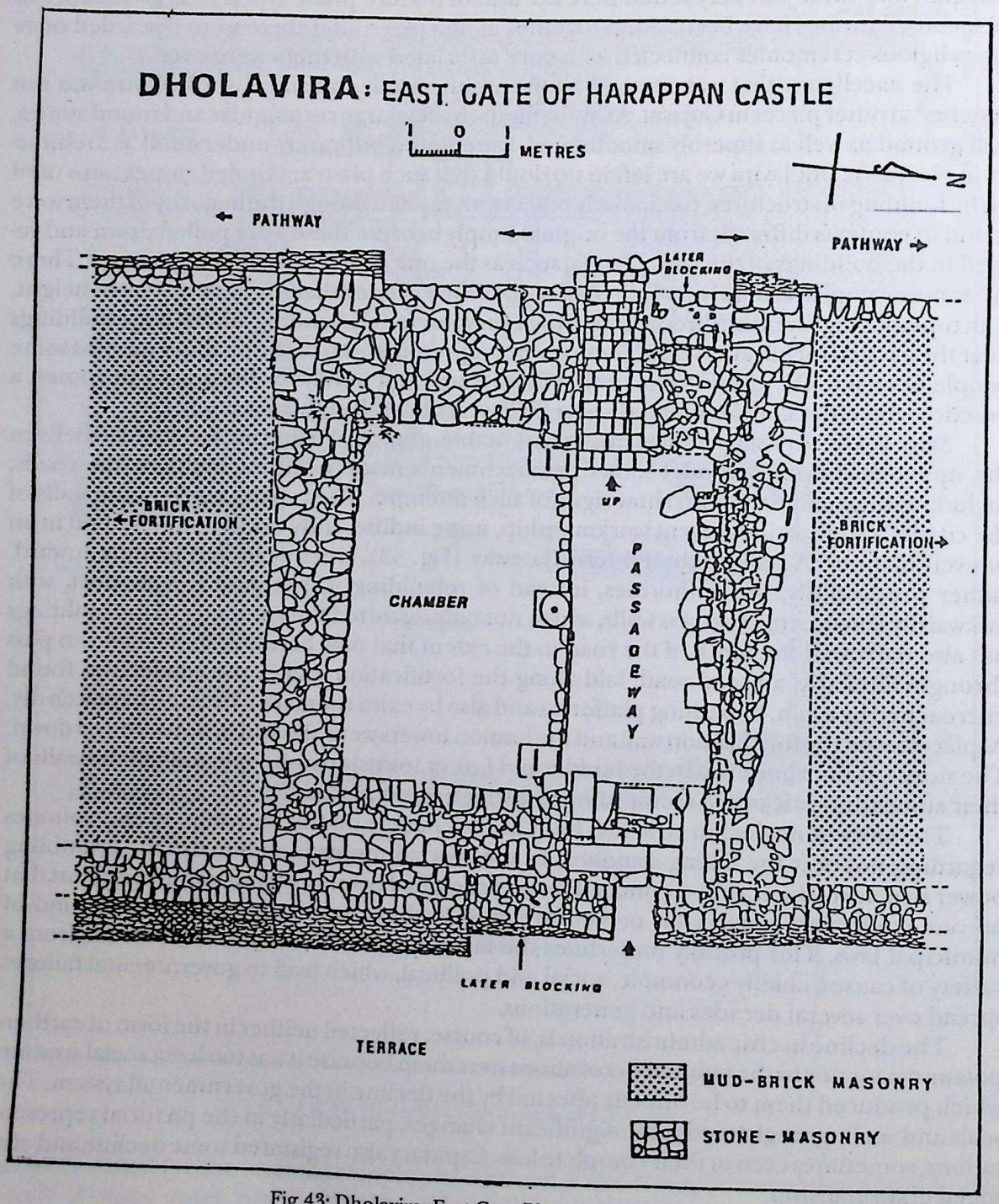

Fig.43: Dholavira: East Gate Plan of the Castle.

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and the remains of various crafts show the same phenomenon. Smaller sites such as Alamgirpur near Delhi also registered similar signatures of decline.

THE INDUS-SARASVATĪ CIVILIZATION: THE LATE PHASE

The Late Phase of the Indus-Sarasvatī Civilization witnessed strong regional differences with only one common factor: all the major sites show continuity in crafts and some use of writing but loss of cities. We will start with Stage VI of Dholavira.

Dholavira Stage VI: The sixth stage of culture at Dholavira is the culmination of the process of decline that was registered in Stage V. What was once a beautiful city, during Stage IV, declined to a decaying township in Stage V, equated with the Late Phase of the Indus-Sarasvatī Civilization. However, the settlement still remained a city, though a dilapidated one. In stage VI, unfortunately, it became an apology of a city of the Indus-Sarasvatī people. Some sectors were completely deserted while some deserted areas were reoccupied with flimsy houses built over the debris of the houses of the earlier periods. Roads and lanes now became meaningless and so also the fortifications, encroachment on them having become very widespread. Even though the water-reservoirs remained in use their upkeep was utterly neglected and silting made them extremely shallow and less viable.

The people started pulling down unused and old structures to get stone pillars, pillar bases, drain covers, bricks, etc., to construct new houses, generally small and low-roofed. One can find many such examples among the new constructions.

The Indus-Sarasvatī people of Stage VI at Dholavira continued to make use of their writing on steatite seals but pictures are now practically things of the past, except in rare examples; they were only inscriptions. Since writing and the use of seals were still in vogue, the material culture had declined but not its ethos. The stone weights continued to be in use but broken potsherds, shaped in round, were also used for this purpose. Beads were manufactured and also copper-bronze implements, but the quality of such objects suffered. These facts also suggest that while the material culture continued in its basics, decline had set in and was clearly seen in every walk of life except perhaps in the belief-systems of extra-mundane.

The pottery registered something which tells us a story of contacts not known earlier. For example, Ahar a site in Rajasthan is represented here by its typical painted pottery mixed with the Dholavira pottery. Jhukar, a site in Sindh, is represented at Dholavira by its own plain and painted pottery. In other words, a city which at one time was perhaps engaged in overseas trade, that is one which looked outwards for extensive trade opportunities, now shrank in scope and became completely insular. This is a significant change in economic structure and area of operation. Hence it is called the Late Stage of the Indus-Sarasvatī Civilization. It is a directional change of a new order which had lost its real city-ethos in no small measure; even though writing, seals and weights of the previous order remained in use, these were now only sparingly used. Their form also registered changes; even in the size of the seals and denominations of the weights one can see a marked reduction. The bricks too lost their standardized sizes, generally based upon the 1:2:4 ratio. Eastern, western and southern sector houses were reoccupied but not maintained properly. The northern side suffered most and a new wall was erected there to restrict the area of occupation. New houses encroached upon the road that ran along the inner fortification wall; now the houses were abutting the wall. This is a true picture of a Late Indus-Sarasvatī City and not the one Wheeler painted on the basis of his own interpretation of the latest phase settlement at Mohenjodaro. Wheeler had painted it as dead and inflicted upon by the invading Aryans, although those who perished in the so-called massacre of Mohenjodaro were never proved to be non-Aryans either ethnically or

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linguistically. Infact it was a case of creating a myth to buttress an existing myth, both remain unproven.

It appears that the end-phase of Stage VI was marked by large-scale desertion of the site, may be due to famine, which very often occurs here even today because of its peculiar location and meagre rainfall.

Stage VII: The seventh stage, which begins with the reoccupation of the site, after a break in occupation for a considerable period of time, also marks the end of a long process of decline and decay. Sometimes we wonder if we are at all justified in including it as a part of one and the same process, the decline of the Indus-Sarasvatī Civilization. It appears that those who came back to this site had forgotten their past almost completely, even if they were the same people, whatever the time-gap. They built their houses in the form of round huts, only the upright wall being of mud or mud-bricks. Some rectangular huts of similar constructional details also came up. The roofs in both types of hut-houses were of the same kind—thatched, using wood, clay and mud, and were conical and barrel shaped respectively. They remind us of the houses built at sites like Nevasa and Navadatoli in Maharashtra and Madhya Pradesh during the Chalcolithic Period, datable to the early to mid second millennium.

When we take an overview of the entire history of the settlement of Dholavira we find that the city's maximum area-coverage was during Stage IV when the inner space of the fortification measured 771 m from east to west and 616.80 m from north to south, the ratio being 5:4. The citadel or the upper township measured 114 m from east to west while from north to south it measured only 92.50 m, the ratio being the same 5:4. The excavator, R.S. Bisht, points out to the use of the same ratio in the construction of Vedic altars, as mentioned in the *Sulba Sūtras.* Bisht also informs us that the citadel covered one forty-ninth of the area, in Stages III and IV, and that seven is a very important number in the Vedic tradition—*sapta-Sindhu, saptaṛṣi, saptapadī,* seven horses of Sūrya, seven heavenly regions, etc. Be that as it may, it is to be noted that in its basic characteristics, Dholavira was planned like other major Indus-Sarasvatī fortified townships. Here also major roads are found crossing each other almost at right angles, houses are grouped in blocks created by lanes and by-lanes, and the gateways opened the city from more than one side. Since the rainfall was very low and the houses used sand-filled jars for the discharge of bathroom water, covered public drains were only rarely built.

And finally, a quick look at the graves. Architecturally these are of six types, some oriented north-south and some east-west, a fact which may mean that the city was cosmopolitan—people of different faiths lived together and shared one and the same material culture. The six types of graves were:

(i) *Underground Cist:* A rectangular pit, having walls faced with large and heavy stone slabs and covered with a similar stone slabs. In effect, it was an underground stone box or cist.

(ii) *Pit:* This type contained grave-goods, generally in the form of earthen pots and pans. However, none of them yielded skeletal remains.

(iii) *Cairn Circle:* A circle of stones laid on the ground and then packed with cairn stones. Again no bones.

(iv) *Collective Stone Circle:* A large stone circle containing within its periphery several small stone circles. No bones.

(v) *Barrow:* A large crescent-shaped earthen mound. Partly excavated.

(vi) *Cenotaph-on-Barrow:* A stone cenotaph placed over earthen mounds. Air photographs show that these high earthen mounds served as bunds as well for at least three sides of a shallow water-reservoir.

So far none of these suspected graves has yielded any skeletal remains, a feature of many 'graves' at Kalibangan, although chemical analysis of the earth from them may reveal that the

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few fragmentary bones which these 'symbolic graves' may have entombed got completely disintegrated.

It is clear that, so far, we have the evidence of only 'memorial graves' unless proved otherwise on further study as noted above. At some other places in Gujarat and Rajasthan, such as Amreli and Kalibangan similar evidence has been recorded although it is hoped that at least a few of them do contain full skeletons, as at many other Indus-Sarasvatī sites, which will be brought to light some day. In at least one example of the rectangular pit type, the pit was shaped like an oval box with the help of clay and mud and it was hoped that in this one at least a complete skeleton would be found because on its base as well as top used for offering earthen pots and pans were found well arranged. It may, however, be noted that only some ash and charcoal pieces were found in the grave. Maybe the body was cremated elsewhere and this structure represented only a memorial. If so, we have here an example of cremation, a fact recorded at only a few sites. A. Ghosh had also encountered evidence of cremation in his excavations conducted at Tarkhanwala Dehra in the Sarasvatī basin as far back as 1951.

It is not easy to interpret this phenomenon of the so-called memorial graves in terms of social structure or social components of several ethnic groups but it is a phenomenon that has been noticed, as noted above, elsewhere too, for example at Kalibangan. The earthen mound burial, if the mounds really served as barrow graves, will, of course, be an entirely new type so far not found elsewhere. The cairn-circle type, generally found with the megaliths of south India as well as Baluchistan during the Iron Age, were, however, noticed elsewhere also, albeit rarely, for example at Amreli. This may indicate that the human response to save the grave from destruction assumed different forms which different people adopted at different times in history.

Dholavira is very rich in natural resources which, as noted at the outset, may have brought people here from different places. Stones and minerals such as sandstone and the quartz group of minerals of a large variety dot the island at various places. So also the trees, the wood of which may have been used in boat-building, a continuing practice. A variety of sea-shells are used in making ornaments such as bangles. Cotton, wheat, barley and lentels are cultivated on a limited but self-sufficient quantity, in two crop seasons. Kacch is also known for its strong domesticated horses as well as wild onagers. It is possible that it was a prominent coastal trading post for those enterprising Gujarati traders who engaged in long-distance trade with the Persian Gulf towns as well as the cities on the Indus then as now. Similar was the situation at other coastal sites such as Lothal, Kuntasi, Balakot and Sutkagendor. Some thoughts on long-distance trade.

LONG DISTANCE TRADE: SOME ASPECTS

This brings us to an outstanding aspect of the Indus-Sarasvatī Civilization—its so-called 'foreign' or long-distance trade. Much has been written and speculated upon this subject.[23] We do not wish to repeat all that here. We will only take a fresh look on this item in the light of new discoveries. Recently, a large earthen pot with the stamp of an inscribed seal on its shoulder has been found at Mohenjodaro. Tosi and several other scholars engaged in re-exploring the site studied it in proper context. Apparently, the pot contained something precious, hence its mouth was closed with cloth and then a seal was affixed on the partially wet clay fixed on the knot. From Kalibangan also a piece of clay was found with a stamp-mark and impression of cloth as well as a knot, obviously tell-tale evidence for the above kind of sealing. The same was true of several examples found elsewhere—Harappa, Lothal, etc. It is, therefore, clear that, in spite of the fact that sealings found at Indus-Sarasvatī sites are very few compared to about 3000 odd seals found so far, still the function to which the seals were put

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was not more than a guess, but not now. Trade was the proper context, not religion, even though at least some pictorial representations on them may have had roots in religion, rituals and mythical stories. What was of real importance was the written text which unfortunately still remains to be deciphered.

In this context, it may be recalled that a number of Indus-Sarasvatī seals have been found in Mesopotamian towns such as Umma, Lagash, Ur, etc., as well as in Oman, Bahrain and Failaka islands in the Persian Gulf (Fig. 44). Undoubtedly, their occurrence in levels, datable from the pre-Sagonid period to Isin-larsa period, that is around 2600 BC to 1250 BC, shows trade contacts. But is that all? Tosi had raised some important questions in this context. He believes that the trade-contacts between 2334 BC, i.e., the period of coming of Sargon of Akkad (II) to around 1900 BC, i.e., the pre-Hammurabi period, was such and so close that it must have affected the society also in more than one way. We will return to this a little later. First the nature of trade itself.

To begin with, unless a sufficiently high level of resource mobilization is achieved by a culture on the basis of its own well-organized internal trade pattern, as noted above, it can hardly hope to export items to far-off regions over sea-routes and land-routes on a regular basis and in an effective manner. Mobility of the people from Punjab sites to Sindh sites, from Sindh sites to sites in Rajasthan and Haryana, on the one hand, and to Gujarat on the other, must have been achieved in gradual stages by establishing land, sea and river routes. Short-distance routes are normal amongst all settled communities but they become long-distance routes when enterprising traders start joining them by frequenting them for commercial purposes. It is through these routes that natural resources were mobilized for manufacturing goods for trade, for example, carnelian from Gujarat, copper from Rajasthan, tin from Baluchistan, lapis lazuli from Hindu Kush and central Baluchistan, lead from southern Turkmenia, chert from Sukkhar, hardwood, perhaps from Himalayas, appear to have been procured and then sent to various industrial centres respectively using them as raw materials. These are only a few of the trade items, archaeological evidence includes many others such as sea-shell, gold, silver, turquoise, etc. Not only the variety but also the quantum of trade increased gradually from 3000 BC to 2000 BC. Production was backed by a high level craftsmanship in these raw materials. Long-distance trade, even within the country must have been a very complex affair but what is significant but not known to us is the nature of controls. In other words, in the absence of deciphered texts on seals, tools, bangles, pots, etc., it is hard to conceive the rules and regulations which governed trade between two cities located at long distances. This involves the question of political set-up of the Indus-Sarasvatī peoples; unfortunately from 1924 many guesses have been made by scholars in this regard. Democracy, theocracy, aristocracy, oligarchy, chieftainship, kingship, and now empires and emperors have all been postulated, but, in the absence of deciphered texts, one man's guess is as good as another's.

Still, let us now deal with the objects which the Persian Gulf people may have obtained from India during this period so that we can get some idea about the civilization's external trade (Fig. 45). Unfortunately, we get very little help from the Indian sites. Except for Lothal which has produced a single Persian Gulf seal, no other site has produced proof of Persian Gulf exports to India if there was any. However, if Melluha, the region repeatedly mentioned in the Akkadian texts of mid-third millennium Mesopotamia was indeed the Indus-Sarasvatī region, which appears to be so on the present showing, a subject on which scores of archaeologists have written, then the Akkadian terracotta tablet inscriptions found in Mesopotamia certainly throw a flood of light on the nature of materials which the Persian Gulf and Sumerian people obtained from India—copper, carnelian, lapis, sea wood, peacock, gold dust, date palm, ivory objects, stone and shell inlay work, gold ornaments, and ornaments of carnelian and other semi-precious stones, hardwoods, rare animals, birds and slaves. It is of great interest to us to note that, in a commemorative inscription, Sargon of Akkad (2334 BC

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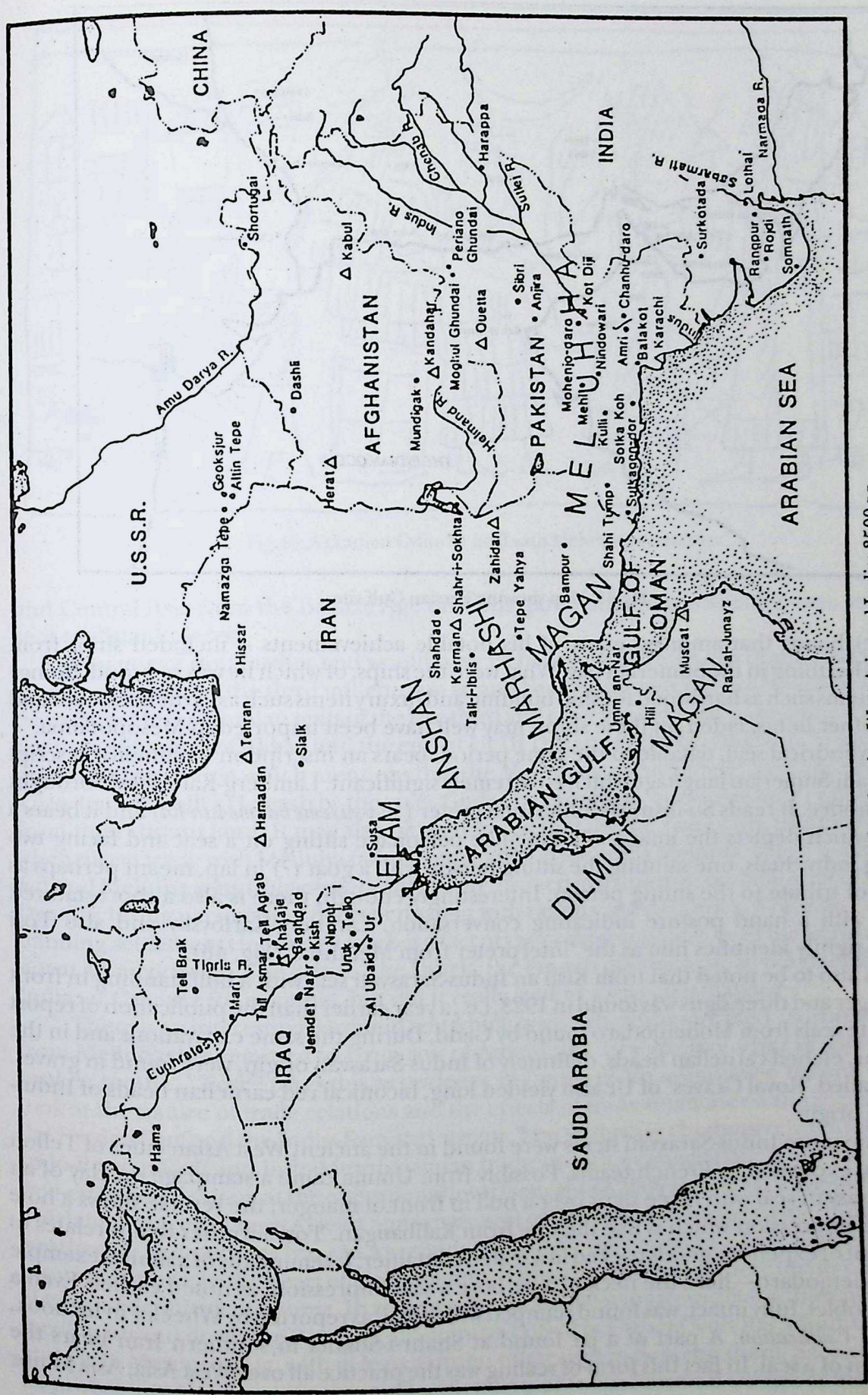

Fig.44: Map showing West Asia and India: 3500 BC.

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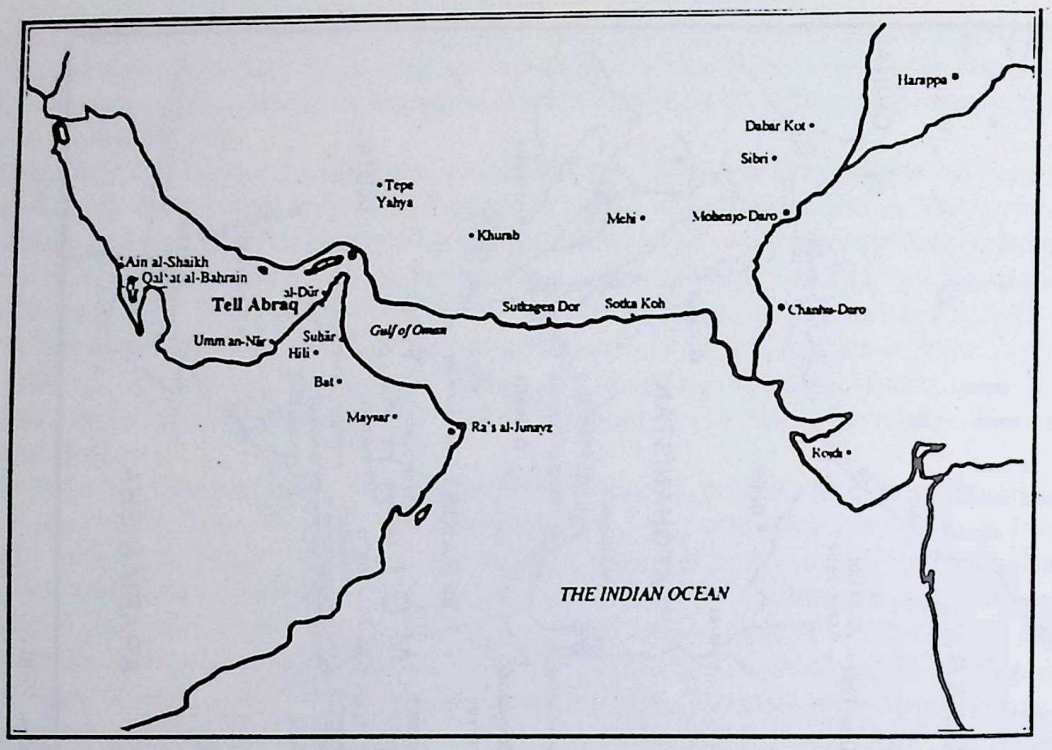

Fig.45: Map showing Persian Gulf sites.

-2279 BC) boasts that amongst many of his notable achievements is included ships from Melluha berthing in the Sumerian bay. What were the ships, of which he was so proud, doing? Critical items such as hardwood for ship building and luxury items such as carnelian beads and several other items, laden on these ships, may well have been imported in Mesopotamia.

A cylindrical seal, datable to the same period, bears an inscription in cuneiform script and Akkadi-Sumerian language which is extremely significant. Lamberg-Karlovsky[24] brought it to my notice. It reads Su-ilisu, Meluhha interpreter (*su-i-su/eme bal me-luh-ha*) and it bears a picture which depicts the image of a king-like personage sitting on a seat and facing two standing individuals, one saluting the sitting person with a goat (?) in lap, meant perhaps as an item of tribute to the sitting person. Interestingly enough, there is also a short-statured person, with a hand posture indicating conversation. Lamberg-Karlovsky and also Tosi perhaps rightly identifies him as the 'interpreter from Meluhha' (Fig. 46).

It is also to be noted that from Kish an Indus-Sarasvatī seal with a bull standing in front of a manger and three signs was found in 1923, i.e., a year earlier than the publication of report on steatite seals from Mohenjodaro found by Gadd. During the same excavations and in the same year, etched carnelian beads, definitely of Indus-Sarasvatī origin, were found in graves. The so-called 'Royal Graves' of Ur also yielded long, biconical red carnelian beads of Indus-Sarasvatī origin.

Some more Indus-Sarasvatī items were found in the ancient West Asian cities of Telloh and Susa, excavated by French teams. Possibly from Umma came a stampage on clay of an Indus-Sarasvatī seal with three signs over a bull in front of manger; the reverse shows a hole and cloth impression which is like the one from Kalibangan. Tosi surmises that it relates to a shipment of expensive goods packed in a sealed container. It reminds us of a similar example from Mohenjodaro—here the neck of a jar bore a seal impression, as noted earlier. Even a pointed goblet, fully intact, was found stamped with a seal, as reported by Wheeler in his book, *The Indus Civilization*. A part of a jar found at Shahr-I-Sokhta in southern Iran bears the impression of a seal. In fact this form of sealing was the practice all over West Asia, Asia Minor

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Fig.46: Akkadian Cylinder Seal with Meluhhan translator.

and Central Asia from the Bronze Age onwards; pots containing valuables were sealed and sent to distant places.

Tosi goes a step further and would have us believe that Indus merchants had settled in Sumar at the end of the third millennium BC and became increasingly *assimilated* there, as we learn from Mesopotamian texts of the late third and early second millennium BC, i.e., between the time of Sargon of Akkad and the end of Ur III Dynasty (2330 BC-2000 BC). As evidence he quotes an inscription which mentions that the Melluhans contributed to the construction of a new temple built at Lagash by the ruler Gudea by supplying 'wood and other raw materials' from their distant land. It may also be mentioned that, by the end of the third millennium, when direct trade with Melluha fades from textual evidence, a Melluha village (*e-duru me-luh-ha*) and Melluha sons (*duma-meluh-ha*) are mentioned in a dozen economic texts of the Ur III Dynasty, listing persons and debts or dealing with rations and deliveries of cereals. Long-term standing settlements in foreign lands is a fact of the commercial history of the world and need not at all surprise us. The British, the Dutch, the French did the same in nineteenth century India, at Calcutta for example, but did it really lead to social assimilation?

There is an interesting Sargonid text which goes, 'where a man called Lu-Sunzida, a man from Melluha, has remitted to Urur, son of Amar-Luku 10 shekels of silver as payment for a broken tooth....' Tosi[25] takes this as evidence in favour of his assimilation theory. But let us look at the nature of trade-relations and the effects of trade-relations on the society both in the Persian Gulf and the Indus-Sarasvatī region. Two things are absolutely clear: one, that the Indo-Persian-Gulf and Indo-Mesopotamian trade was not a casual affair; it was a regular and well-established system at the operational level from about 2600 BC to 1900 BC, or perhaps even a bit later, we are not sure. At least one square seal of the 'bull and manger' type, though highly weathered, and perhaps lying in a secondary context, was found in a Late Kassite (1250 BC) house at Nippur, in the heart of Mesopotamia. Thus, the evidence is there but its nature is not clear, and definitive of its time. In any case, for about 600 years from 2600 BC Indian ships were moving up and down the Persian Gulf, joining Lothal in Gujarat with Ras al-Junyaz in Oman and Ur in Mesopotamia, with at least a dozen other sites in between them. Secondly, that, in all probability, there were some small settlements of Indus-Sarasvatī traders at the townships

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of the Mesopotamian and Gulf sites, to whom the law of the land was strictly applied, and no foreigner from the Indus-Sarasvatī region, and from any other region for that matter, could be harassed. Foreign trade flourishes only in conditions such as these—equality before the law of the land. This is the principle of free and fair governance. This is not 'integration', not at all. The British ruled in India but never got integrated. The Dutch and the French traders too had their own localities in Indian townships like Calcutta and Pondicherry but never got integrated in the local population. They are now nowhere in India. What is important to understand is the nature of the trade.

Shashi Asthana,[26] in one of her papers, visualized the system of trade which requires careful consideration: the 'agent system'. Those who carried the Indus-Sarasvatī seals in the Gulf countries and the Mesopotamian cities were the agents of the Indian merchants and they must have been using the seals for stamping goods, which they were sending to their masters in India. Now the question is, who gave the merchants the authority to use the seals and also on which occasions? Plainly, those authorities who ruled or else the guilds which managed the trade in the homeland, i.e., India, alone could accord permission to use their seals. It is possible that, when the Indus-Sarasvatī agents acquired objects locally, to be sent to India, perhaps in the returning empty ships, they may have used them so that when the cargo reached the Indus-Sarasvatī ports, such as Dholavira and Lothal, these objects were immediately identified, kept in the warehouses and eventually sent to the establishments of the owners. These could also be used by a foreign-settled Indian merchant to another foreign-settled Indian merchant in case goods or messages were sent. It is possible that the Indian agents in Mesopotamia who engaged in local trade, seafaring between Oman, Bahrain, Failaka, Sumer, etc., also used them. The basic point to note is that since none of them is bilingual it is doubtful if these had any meaningful role to play in the life of those who could not read the script. The comparative absence in India of typical cylindrical Mesopotamian seals and sealings inscribed with Akkadian cuneiform script, on the other hand, indicates that the Gulf merchants relied on the Indian merchants to do business on their behalf too. The one single example of a round Persian Gulf seal found at Lothal will at best indicate that, on some occasion, a Persian Gulf merchant also played a role similar to the one which the Indus-Sarasvatī agents played in the Gulf region.

But then how to explain the occurrence of at least half a dozen Persian Gulf type seals with Indus-Sarasvatī writing and the 'bull and manger' picture in Ur III levels in Mesopotamia, particularly those combinations of signs which are not found at the Indus-Sarasvatī sites, a fact which may indicate that the word or the name hidden in them may be of local origin. The explanation appears to be like this: some Indian merchants employed Gulf traders to act on their behalf, a practice which is neither new nor unknown to the Old World. The sealings could be read easily by the Indus-Sarasvatī merchants for whom the goods were meant.

It is common knowledge that not a single bilingual seal and sealing has so far been found either in India or Mesopotamia or the Gulf countries. How to explain this? The Indus-Sarasvatī people remained absolutely tied up with their country, with their language and with their script. And so were the Gulf people. Their mutual relationship hardly crossed the limits of economic interests. Had the people got assimilated socially also, that is by marrying each others sons and daughters, we may have got not only bilingual seals but visual representations on seals with elements of both the civilizations.

It is, therefore, only in the economic model that we can explain the Akkadian cylindrical seal's picture in which the services of an interpreter were used between the Meluhhans and the Sumerians. It is only in this model that we can satisfactorily understand the payment of 10 shekels of silver as payment to a Meluhhan who was assaulted by a Mesopotamian in which the poor Meluhhan lost a part of his tooth. Further, the settlement of the Indus-Sarasvatī people at Shortughai in Afghanistan, using their own square steatite seals and their own writing on

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them, can also be explained through this model. This model can also explain the occurrence of two Indus-Sarasvatī seals, ivory objects, copper objects, terracotta, etc., at Altin Depe in south Turkmenia.[27] In each example, the rigidity and exclusiveness of the Indian merchants is quite apparent.

Here it may not be out of place to mention that of the 25-odd cylinder seals found at Indus-Sarasvatī sites, not one shows the presence of Cuneiform script, the use of Sumerian-Akkadian language, or even Mesopotamian pictures and icons. Why did it happen the way it happened ? Plainly, the Indus-Sarasvatī people borrowed only the *form* of the seals used in Mesopotamia, and that too for limited use where a narrative picture was to be used, and that too bearing their own motifs, and not Mesopotamian or Gulf motifs. This also shows that the Mesopotamians did not look at the trade the way the Indus-Sarasvatī people looked at it. The Indus-Sarasvatī long-distance navigational trade with regions in the Gulf countries and Sumer appears to have been motivated more by the considerations of export than import of raw materials while the long-distance overland trade with Afghanistan clearly shows that the Indus-Sarasvatī people of the Mature phase used the settlement at Shortughai for a short period only.

The fallout of this kind of trade, particularly in sea-borne trade in the intermediary regions, was no less important. The people of the sea-coast of Oman needed foodgrains to supplement their sea-food, which was otherwise their only source of subsistence. Bahrain and Failaka islands also needed hardwood, wheat and barley, besides luxury items of ivory, carnelian, etc. For internal consumption, and perhaps for re-export too. The Indus-Sarasvatī cities seem to have supplied these items to Ras al-Junyaz and Hili-8 (Oman Peninsula)[28] (Fig. 47), Failaka (Kuwait) and several sites in Bahrain. At Ra's al-Junyaz an inscribed potsherd (Fig. 47a) and, an inscribed copper seal with classical Indus-Sarasvatī characters (Fig. 48) were found amongst a large number of Indus-Sarasvatī pots and potsherds. At Tell Abraq,[29] Indus-Sarasvatī chert weights (Fig. 49), incised pots, copper blade-axes, etc. (Fig. 50) have been found. It, therefore, enlarges the gamut of items of material culture exported to Persian Gulf countries. The Hili-8 site in the Oman Peninsula has also yielded several kinds of Indus-Sarasvatī pottery. Failaka has yielded Gulf type round seals with Indus-Sarasvatī characters engraved on them along with Indus-Sarasvatī cubical chert weights. Bahrain has also yielded similar round inscribed seals of 2200-2000 BC (Fig. 51) and cubical weights, the two important items of highly standardized trade. There is, therefore, absolutely no doubt that, during the latter half of the third millennium BC, the Indian merchants played a role similar to that of present-day multinationals.

In this context, it may also be mentioned that between Oman and Sindh there are at least two well-fortified coastal sites of the Indus-Sarasvatī Civilization: on the Arabian-Makran coast—Sutkagendor, near Gwadar, and Sokta Koh, near Pasni, around 150 km east of Sutkagendor. Both were excavated by G.F. Dales who called them Kulli Culture sites, which is now taken by scholars only as a variant of the Indus-Sarasvatī Civilization.[30] As mentioned earlier, a potsherd impressed with three Indus-Sarasvatī characters, was found at Tepe Yahya (in IV-A level dated to BC 2200-2000) in southern Iran excavated by C.C. Lamberg-Karlovsky. Etched carnelian beads were found at Hissar (III-C levels) and also at Shahdad (Fig. 52) in northern Iran as mentioned earlier also. But then what do we surmise from these stray and far between examples of Indus-Sarasvatī items? Certainly, the trade situation at the Iranian sites was not at all comparable with that of the Persian Gulf sites, but it does emphasize the fact that between 2200 BC and 2000 BC luxury items of the Indus-Sarasvatī Civilization were in demand and the people in Iran got them either directly or indirectly, perhaps the latter. Trade is a very complex affair and no single model can explain all situations, certainly not the unilinear model. How many hands an object of luxury of well-known brand changes before it reaches the actual consumer even today is very often difficult to know.

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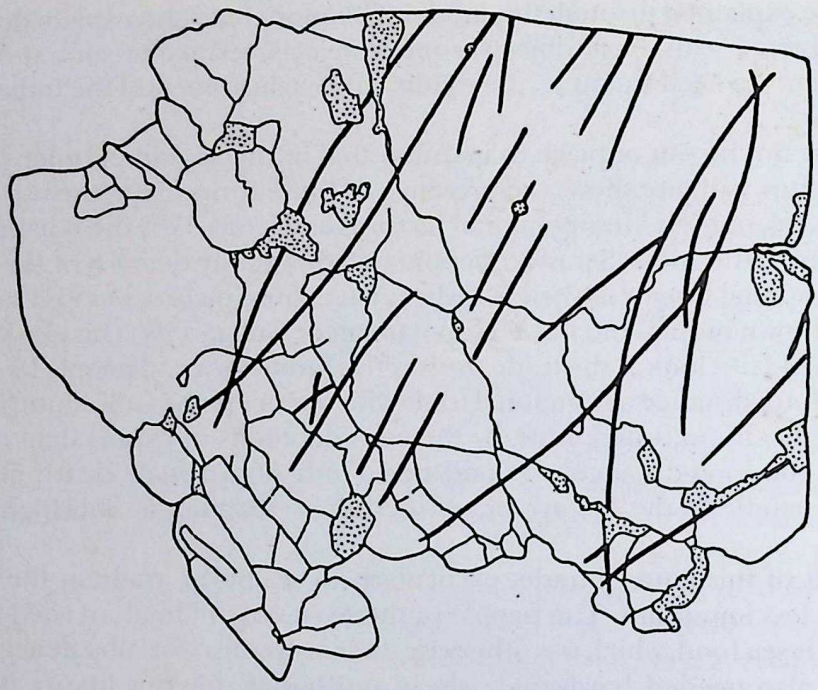

Fig.47: Hilli-8: Indus-Sarasvatī Pottery.

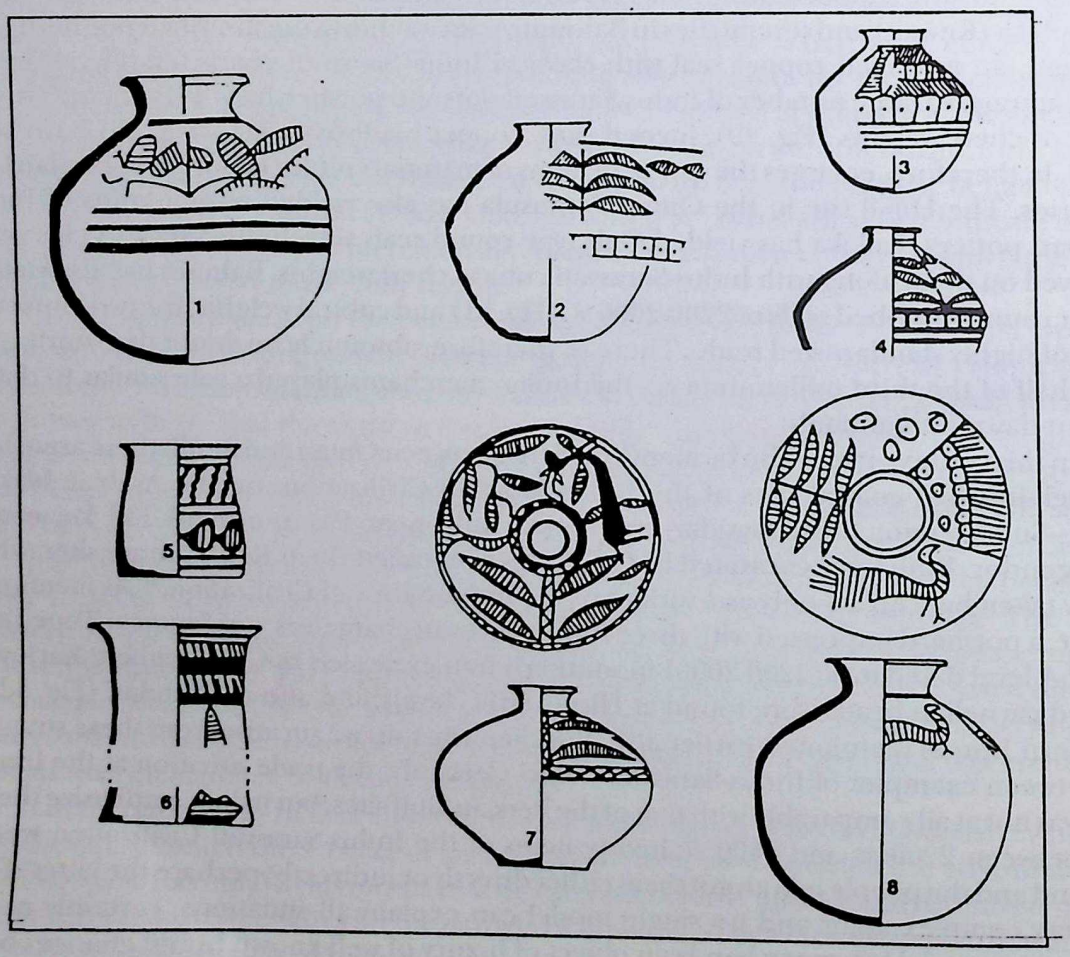

Fig.47a: Potsherd from Ras-Al-Junayz with Indus script.

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Jim Shaffer[31] once thought of nomadic migrant traders whose role can also not be minimized in the context of highland village cultures. Places like Tepe Hissar, Shahdad, Altin Depe and Shortugai (Fig. 53) may have been the distribution points while Tepe Yahya may have got the stamped pot through a Makran site or even directly from a Sindh site. It may be noted that none of the Iranian sites has so far yielded an Indus-Sarasvatī seal and sealing as the way southern Mesopotamian and Gulf sites have done, and to some extent this is applicable to southern Turkmenia also. Here Altin Depe (Fig. 54) is an isolated site, overlooking the resource areas for gold, silver, copper, lead, etc., determining the role that the site may have played in the commercial interests of the Indus-Sarasvatī Civilization which needed in abundance a large variety of metals and minerals. As hinted earlier, these were obtained not only from Shortugai (Fig. 55), beyond the Hindu Kush, overlooking the Oxus as well as the Khorasan, the Kizil Kum outcrop in south Turkmenia and Uzbekistan, but also from Baluchistan sites like Nausharo, Pathani Damb and Judeiro-daro along the Kirthar, and Dabar Kot in the Suleiman plateau, the latter an important potential area for future excavations in terms of mobilization of hill resources of Baluchistan (Fig. 56).

Fig.48: Copper Seal from Ras-Al-Junayz.

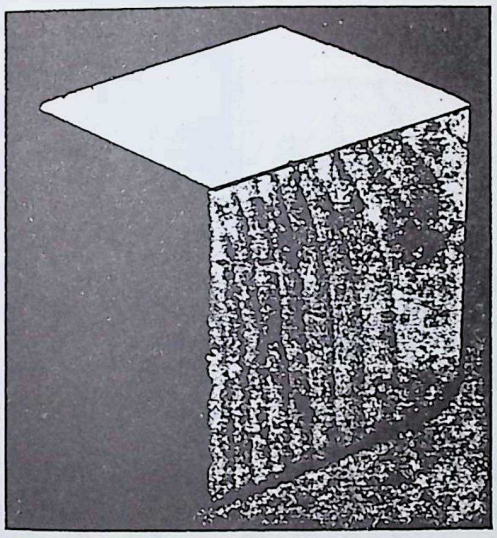

Fig. 49: Chert weight from Tell Abraq.

This fact can also be understood in the light of the location of Manda, an Indus-Sarasvatī site on the Chenab in Jammu, which even now stealthily supplies Himalayan wood to Pakistani Punjab: the logs of wood cut and thrown in at the mouth are caught at Manda but during the floods many of them manage to escape.

The Gujarat Indus-Sarasvatī sites, like Lothal, Surkotada, Dholavira, etc., served two purposes—as centres for resource mobilisation for carnelian, shell, etc., and as ports for export of Indian goods from various places to West Asian market-towns.

The Indus-Sarasvatī trading system certainly integrated, in one way or an other, south-eastern Arabia, the Persian Gulf islands and the coastal regions of Mesopotamia, Iran, Turkmenia and Uzbekistan. However, in the birth of the Indus-Sarasvatī Civilization the culture of none of these regions had any significant role to play: the excavations conducted at Mehrgarh and Nausharo have once and for all set at rest the age-old controversy over whether or not the Indus-Sarasvatī Civilization was the result of the Mesopotamian experiment where, it was once claimed by Wheeler, cities had come up possibly a little earlier than they came up in the basins of the Indus and Sarasvatī, a theory which is no longer considered valid because of the revised chronology of Indian sites. The long-distance effective trade between the Indus-Sarasvatī and West Asia was the *consequence* of the urbanization of the Indus-Sarasvatī and not the cause of the Indus-Sarasvatī urbanization. In a sense, Wheeler was putting the cart before the horse. Not only that, let us not forget that the *forms* of the cities as

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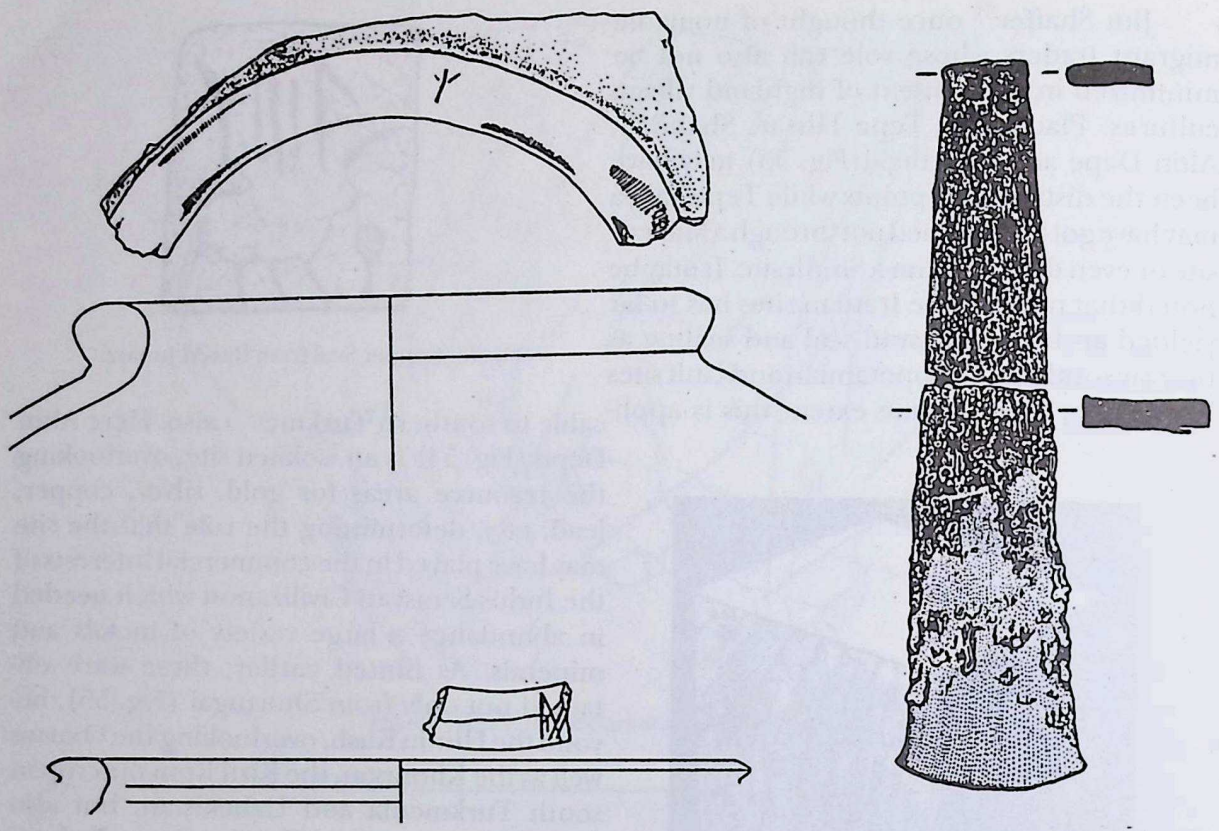

Fig.50: Pottery and Bronze Axe from Tell Abraq.

well as the major culture components of the two civilizations were worlds apart, which could not have been the case had the Indus-Sarasvatī cities and their cultures been 'inspired' by the Mesopotamian experiment. As said above, this is not to say that India, Turan, Iran, Turkmenia and Mesopotamia had absolutely no trade contacts before the twenty-sixth century BC, the time from which onwards we start getting material evidence of well-established regular trade transactions between India and Mesopotamia through the Gulf. These were definitely there in the late fourth and early third millennium BC, but these transactions were sporadic and irregular and the mobility of the people was limited to peripheral areas of Baluchistan and Afghanistan only; the plains of the Indus and the Sarasvatī were out of bounds for these West Asians.

Fig.51: Seal from Bahrain.

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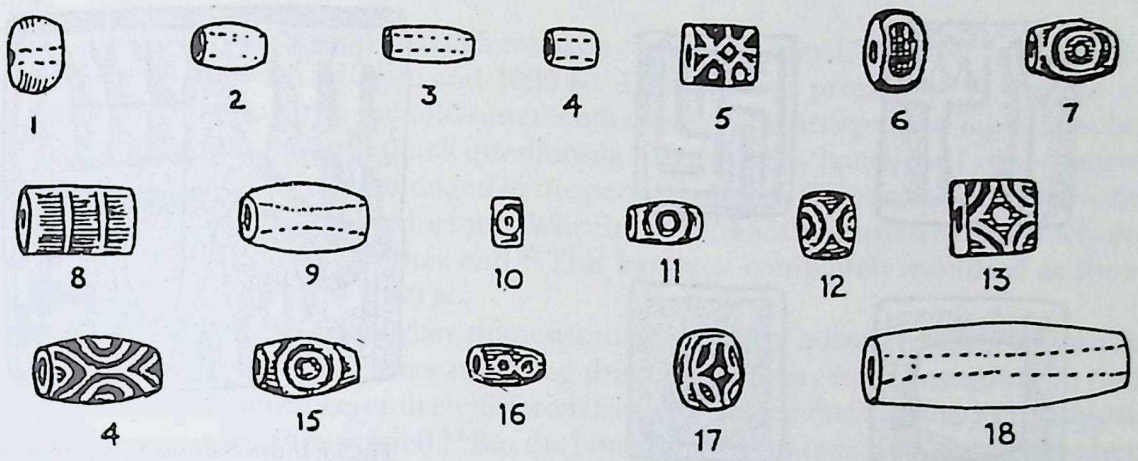

Fig.52: Etched Carnelian beads from Shadad, Iran.

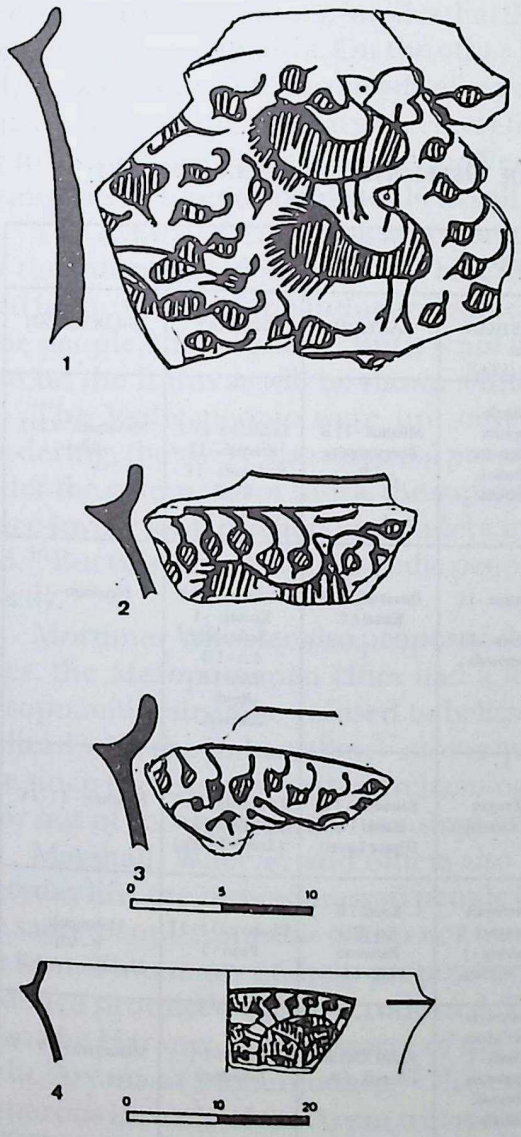

Fig.53: Indus-Sarasvatī Pottery at Shortughai, Afghanistan.

Culture-change is not to be compared with changing undergarments every morning and evening. It is a very tough matter and presupposes a number of historical, cultural and religious situations; trade-contacts alone is never enough to change another's system of culture and social order, even though it helps bringing two sets of people near each other and allows them to interact at various levels. Indo-Mesopotamian, Indo-Gulf, Indo-Iranian and Indo-Turanian trade contacts led only to trade exchanges and not to culture-changes. This is one of the lessons of the history of third millennium India, which was economically more powerful than present-day India, and whose towns were more civilized than the towns of present-day India.

NEW LIGHT ON OLD PROBLEMS

The archaeological work done at Harappa and Mohenjodaro during the mid-twentieth century, while throwing a very welcome light on a completely unknown chapter of Indian history, viz., the Bronze Age Urbanism of the third millennium BC Indus-Sarasvatī, it also simultaneously raised a host of seemingly unresolved problems. The most prominent of these are related to the question of the relationship or non-relationship of the Indus Civilization with the culture formed by the Early Vedic people in India. Till recently, the general view has been that the two cultures were absolutely unrelated; in fact the former was said to have

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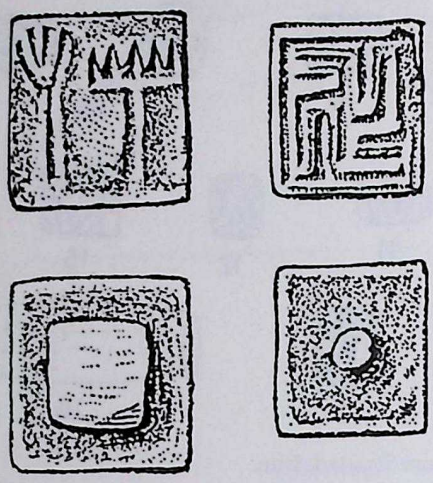

Fig.54: Indus-Sarasvatī style seals from Altyn Depe.

Fig.55: Indus-Sarasvatī seal from Shortughai, Afghanistan.

Chart I : INDUS - SARASWATI CIVILIZATION : STAGES OF DEVELOPEMENT (4000 B.C. - 1500 B.C.)

PERIOD	APPROXIMATE TIME BRACKET	REGION AND CULTURES					
		PUNJAB	SINDH	RAJASTHAN & CHOLISTAN	HARYANA	GUJARAT	BALUCHISTAN
LATE PERIOD	1500 B.C. To 1900 B.C.	Cemetery - H Nagar Dadheri Katpalon Sanghol - I	Jhukar	Kudwala Lurewala Gamanwala Siddhuwala Shahiwala	Mitathal - I I B Bhagwanpura - I B -	Dholavira - V I Kuntasi - I I Surkotada - I C Rojdi Lothal B	Mehargarh - V I I I Sibri
MATURE PERIOD	1900 B.C. To 2600 B.C.	Harappa - I I I C B A	Mohenjodaro (Upper Levels) Balakot - I I	Kalibangan - I I Ganeshwar - I I Ganweriwala	Banawali - I I Kunal I C	Dholavira - I V Kuntasi - I Surkotada I A - I B Padri I I Rojdi Lothal A	Nausharo - I I
TRANSITION PERIOD	2600 B.C. To 2800 B.C.	Harappa - I I Kot Diji IB	Mohenjodaro (Intermediate Levels) Balakot - I I (Lower Levels)	Kalibangan (I - I I Overlap)	Banawali - I C Kunal I B (Upper Level)	Dholavira - I I I Surkotada - I A (Lower Levels)	Nausharo - I I - I C
EARLY PERIOD	2800 B.C. To 3500 B.C.	Kot Diji - I Harappa-I	Kot Diji - I Mohenjodaro (Lower Levels) (Pre-Defence)	Ganweriwala Kalibangan - I Ganeshwar - I Sothi Culture	Kunal I B Kot Diji Banawali I A - I B	Dholavira - I - I I Padri - I	Mehargarh V - VII Nausharo I A & B
FORMATIVE PERIOD	3500 B.C. To 4000 + B.C.	Pre-Harappa - I " Ravi Culture " (Pre -Kot Diji) Level Jalilpur - I	Amri Culture Miri Kalat - I I Balakot - I	Ganweriwala Hakra Culture Lathwala - I Bhostanwala Ambrawali Chikrala	Kunal Culture Kunal - I A	Padri I Loteshwar	Mehargarh - I V - V

Fig.56: Indus-Sarasvatī: Stages of Development.

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ended when the latter started, according to Marshall, Wheeler and others, for the reasons set out below.

The Vedic hymns were supposed to have been composed after 1500 BC and compiled in the form of books between 1200 BC and 1000 BC. This view was propounded, though not insisted upon by Max Muller in the mid-nineteenth century and accepted by many scholars, both foreign and Indian, without much questioning. On the other hand, the Indus-Sarasvatī Civilization was believed to have belonged to the period between 2500 BC and 1500 BC, a view propounded and insisted upon by Mortimer Wheeler in 1964 and accepted by many scholars with hardly any modification at either end.[32] This has been completely modified as shown earlier, the bracket is 4000 BC – 1400 BC.

The Vedic people were equestrian, domesticating and using horses in their everyday life while the Indus-Sarasvatī people were not using this animal in any form according to these authors; the two were, therefore, entirely different from each other. In fact, they were opposed to each other as enemies, they opined.[33] But the bones of the domesticated horses have been found at several places as will be shown a little later.

The Vedic literature abounds in references to cattle, particularly the cow, which, according to these authors, implies that the Vedic people were primarily nomadic in habit and pastoralists in occupation. On the other hand, the Indus-Sarasvatī people were primarily not only agriculturists but also city-dwellers engaged in manufacturing a variety of goods and in long-distance trade; the two were, therefore, entirely different people culturally also, according to them.[34] But this is not true, the Vedic people were also metallurgists and they engaged themselves in long-distance trade as will be shown shortly.

The hymns of the Vedas were composed in the basins of the Sarasvatī and Dṛṣadvatī as per the internal evidence of the Vedic literature, while the Indus-Sarasvatī people generally lived in the basins of the Indus and some of its tributaries, therefore the two could not be the same people, they argued.[35] But it is not true, there are many times more sites on the Sarasvatī than on the Indus as will be shown a little later.

The Vedic people were not only nomadic people using horse-driven chariots for wandering, they were also a martial people engaged in warfare, destroying fortified townships under the command of Indra, the supreme Vedic God, while the Indus-Sarasvatī people were peace-loving town dwellers and traders, maintained Wheeler; others simply repeating what he said.[36] But this is not true, the Vedic people lived in a variety of houses in cities as will be shown shortly.

Mortimer Wheeler also proposed the theory that in the formation of the Indus-Sarasvatī cities, the Mesopotamian cities had a lot to contribute, the very idea of a city came from Mesopotamia, since he refused to believe that there were earlier evolutionary stages of this civilization in the Indus valley;[37] others questioned him only rarely during his lifetime. It is not true since there is now ample archaeological evidence to show that the Indus-Sarasvatī cities grew out of Indus-Sarasvatī townships and not modeled after the Mesopotamian cities.

Marshall, Wheeler and others also said that while the Vedic people used iron in their everyday life, the Indus-Sarasvatī people had no knowledge of this metal, hence they were not the same people. But this is also not true since the Ṛgvedic people knew metals (*ayasa*) but not iron. Thus many of these propositions have, of late, not been found acceptable when the evidence produced was re-scrutinized. For example, Indra's invasion of the Indus-Sarasvatī cities like Harappa, the massacre of the Indus-Sarasvatī people by the invading armies of the Vedic Aryans at Mohenjodaro;[38] the end of the Indus-Sarasvatī Civilization caused by the barbarous inroads of the Aryan tribes coming from the west,[39] particularly from Central Asia, and descending down to the plains of Punjab in their horse-driven chariots, as warlike nomadic people. They came in one wave or several waves, pushing out the original inhabitants because of their better weaponry and making them flee towards the southern states of India

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where Dravidian languages are spoken.[40] This somewhat overdramatised scenario, skillfully sketched by the older writers and presently echoed by scholars like Asko Parpola, has now been replaced by a more sober and realistic scenario, thanks to the painstaking researches done by the present generation of scholars in India and abroad. For example, Bhagwan Singh has shown that the Vedic society had a number of craft-specialists and metallurgists who were engaged in 'long-distance' 'sea' and 'land' trade and commerce. It is based upon the internal evidence of the Vedic literature itself. His book *The Vedic Harappans* has innumerable references to this fact. Let us look at the problem afresh.

Backdrop

It is now more or less clear that, around 8000 BC, Late Stone Age nomadic hunters and gatherers started settling down in the hills and the piedmont regions of Afghanistan and Baluchistan. The first permanent villages of these people started domesticating cattle, sheep and goats as well as cultivating cereals like barley and wheat, ushering in the era called Neolithic whose economy was based on agriculture and animal husbandry. Civilization now begins in this part of the world, since sedantariness is the prerequisite for the growth of human management skills which alone leads to various innovations, making the community life of a people change its socio-economic and cultural character from somewhat self-sufficient village units to a highly complex and interdependent city network. There is now ample archaeological, palaeozoological, and palaeobotanical evidence to prove that between 8000 BC and 6000 BC sedantariness became a permanent feature of the lifestyle of a people who chose the wide terraces of the Bolan river in the piedmont of the Kirthar mountains where the river meets the plains of northern Sindh to live on; the place is known as Mehrgarh.[41] Between 6000 BC and 4000 BC these people developed copper and bronze metallurgy as well as craftsmanship in bone, stone and terracotta, besides a belief-system manifested in the formal disposal of the dead, imagery and symbols, leading to long-distance trade and commerce as well as development of rites and rituals connected with the belief-systems. From 4000 BC onwards we see the movement of these people towards the Indus basin and hilly low-lands of southern Baluchistan; this is well attested at sites like Ghazi Shah, Amri, Miri, Kalat, Mohenjodaro, etc.[42]

The date 4000 BC is very crucial in Indian history from yet another point of view. We find the birth of the first villages in the plains of the Indo-Gangetic divide through which also flows the Sarasvatī and its tributaries, such as the Dṛṣadvatī, as well as the tributaries of the Indus like the Ravi, Satluj and Beas. At sites like Harappa and Jalilpur in Punjab and Kunal in Haryana, there are indications that Neolithic-Chalcolithic villages, going back to 5000-4000 BC, with clusters of huts were established there.[43] The 'Hakra Culture' sites in Bahawalpur region, along the lost Sarasvatī, also belong to this category.

In the region round Taxila a similar socio-economic change seems to have occurred. At sites like Sarai Khola we have definite evidence of Neolithic-Chalcolithic villages.[44] In Bannu Valley, there are the remains of the early fourth millennium Neolithic villages at sites like Lewan and Sheri Khan Tarakai.[45]

In the Gomal Valley also the early fourth millennium levels have yielded evidence of Neolithic-Chalcolithic villages at sites like Gumla.[46] In southern Sindh too there were Neolithic-Chalcolithic villages at sites like Balakot, Miri Kalat, etc. during the early fourth millennium.[47] In Gujarat also, both northern and southern, we find Neolithic-Chalcolithic villages at sites like Loteshwar and Padri, etc., going back to the early fourth millennium.[48]

All this clearly shows that, in the process of the formation of the Indus-Sarasvatī Civilization, which was typically a lowland cultural phenomenon, not one but several regions were directly or indirectly involved, as has been pointed out by Mughal.[49] The usual American perception (of scholars like Possehl) that the highland Baluchi cultures, such as the Quetta Culture with roots in Iranian Neolithic cultures of the Zagros Mountains, and the Iranian

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Bronze Age cultures were primarily responsible for the birth and early growth of the Indus-Sarasvatī Civilization, therefore, requires serious reconsideration since the pre-4000 BC cultures leading to the 4000 BC settlements are now locally available in Punjab, Haryana, Rajasthan and Gujarat, particularly at Harappa, where a four metre deposit of handmade black painted red ware with mud-brick houses has been found in early 1996.

Our view is that the roots of urbanism go deep into the Chalcolithic villages. It occurred during the early fourth millennium BC at various places and not one. In other words, priority in terms of chronology alone does not prove that Mehrgarh alone civilized the whole Indus-Sarasvatī region, extending from southern Gujarat to Haryana, Punjab and beyond. In fact, the Mehrgarh pottery, copper objects, shell items, etc. are not found at sites like Padri, Nagwada, Jalilpur, Sarai Khola, etc. Although we are not at all sure as to who were the people who founded the first Chalcolithic villages in the Trans-Indus regions, such as Harappa, it is important to note that at least a thousand years prior to the growth of urbanism in the Indo-Gangetic divide there were Chalcolithic cultures which eventually developed into the Indus-Sarasvatī Civilization.

The process of change was, however, neither unilinear nor uniform although, when we take the overall picture and leave aside the details, we see directional changes which created a pattern in which some sites remained 'resource areas' for the raw materials needed by the craftsmen; some sites developed as 'manufacturing centres', some sites remained camp-sites of the migrating labour, perhaps; some sites developed as small townships playing a vital role in developing trade routes for internal trade, both river borne and land-borne; some sites developed as large cities with centres of multiple activities, including manufacturing, trading and political(?) activities, while some other sites developed as cities of moderate sizes but engaged in import and export business through seaports. The following example noted by Mughal testifies that this was so. It concerns sites he explored along the lost Sarasvatī in the Bikaner deserts called Cholistan:[50]

> The Cholistan has given a good sample size of 414 sites among which 264 sites belong to Early, Mature and Late Harappan Periods of the Indus Civilization. In addition, 99 sites represent an earlier period called Hakra while 14 sites belong to the Painted Grey Wares of the first millennium BC, making a total of 337 sites.
>
> All the sites are not settlements but as observed on the surface fall into several distinct categories; industrial, where craft related activities and kilns for firing of pottery and other materials are concentrated; multifunctional sites combining settlements with specialized activity areas in or near the settlements; purely habitational sites; camp sites marking temporary occupation by the herders and grazers; and two cemetery sites. All the sites are located along or near the changing course of the Hakra River which ultimately dried up around the beginning of the first millennium BC. The area now consists of wide open and level mud flats partially covered with drift sand that has advanced 30 to 35 kilometers eastwards from the original limits of the Thar Desert.

Therefore, there is no single-site origin of the Indus-Sarasvatī Civilization; in its origins many people, many centres, many craft-specializations, many mining activities, many trade routes and many talents of management of long-distance trade and travel got involved in a network of systems dealing with politics, municipality, commerce, and beliefs. And this picture is also reflected in the Vedic literature. This is crucial. Very crucial indeed from the point of view of correlation between archaeology and literature because without this we shall never reach the truth.

The sole reason why the truth was not revealing itself to us in this context was simple enough: the misrepresentation of the economic character of the Vedic society by the scholars

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of literature, that the Vedic society was 'pastoralist', there was neither the craft-specialisation in it nor trade and commerce. Max Muller called it 'most primitive'. Hence, even B.B. Lal suggested in 1951 that the Vedic society is reflected in the Painted Grey Ware villages dated to 1100-600 BC. But once this false shell is broken, the dichotomy between the Indus-Sarasvatī society and the Vedic society completely vanishes. This we will show now. First, the question of the presence or absence of the horse on the Indus-Sarasvatī sites.

The Horse in the Indus-Sarasvatī Civilization

More than twenty years ago, A.K. Sharma[51] identified bones of domesticated horse (*Equus caballus* Linn.) coming from the stratified deposits of Surkotada, a mature Harappan or Indus-Sarasvatī site in Gujarat excavated by J.P. Joshi. He published these findings in *Purātattva* No. 7 (1974). The bones found include leg bones, hoofs, phalanx, molars, incisors and cannon bones (Pl. VI). However, his views remained a suspect in the eyes of disbelievers as noted earlier, till 13 December 1991 when the same bones were re-examined by Dr Sandro Bokonyi from Budapest, an internationally recognized archaeo-zoologist, specializing in horse bones. He declared that the bones belonged to the 'true domesticated horses', *Equus caballus* Linn. This has, therefore, set at rest the controversy raised by the observations of Richard Meadow who had not personally examined the bones in question but still felt (1986) that the Surkotada bones may not have belonged to the true horse. It is significant to note that bones of *Equus caballus* Linn. were found at the site not just from a single layer of a single level; they were found by the excavator in all the levels, from the bottom to the top, spanning the entire period of the Mature Indus-Sarasvatī Civilization of the third millennium. The full scientific report on the excavation by J.P. Joshi. was published by the Archaeological Survey of India in 1990 under the title *Excavations at Surkotada 1971-72 and Explorations in Kacch.*

Fortunately, this did not remain a unique find because if it had been, it would have led to several speculations such as the possibility of a 'one-time import of domesticated horses at one of the Indus settlements'. In 1979, S.R. Rao[52] found the bones of domesticated horses in his excavations at Lothal, also in Gujarat, from the Mature Indus-Sarasvatī as well as Late Indus-Sarasvatī levels. He found even a terracotta figurine of the horse in Lothal (Pl. VII).

Surkotada and Lothal are not the only Indus-Sarasvatī sites where the true horse was in use. Bhola Nath, the archaeo-zoologist of the Zoological Survey of India had, as far back as 1953 identified the bones of domesticated horse within a large collection of animal bones from Area G of Harappa in Punjab.[53] Bhola Nath, in fact, identified the bones of *Equus caballus* Linn. from yet another Mature Indus-Sarasvatī site, Ropar,[54] near Ambala in Punjab, excavated by Y.D. Sharma in 1953.

That Kalibangan in Rajasthan, another Mature Indus-Sarasvatī site, excavated by B.B. Lal, also yielded bones of domesticated horses became quite clear when not only A.K. Sharma but also the archaeo-zoologists of the Zoological Survey of India confirmed in writing on 30 November 1992 that, amongst the bones of many species of animals and birds found there, the bones of *Equus caballus* Linnaeus occur as well.[55]

In 1972-73 the Indus-Sarasvatī site of Malvan in Gujarat was excavated by J.P. Joshi and F.R. Allchin.[56] A.K. Sharma, who also participated in the excavations, identified bones of the domesticated or true horse from this site as well (specimen Nos. 63 and 25 are lumbar vertebra of *caballus* Linn.)

It may be recalled that, as early as 1938, Mackay[57] found a terracotta horse figurine at Mohenjodaro. Wheeler also noticed horse bones too at Mohenjodaro as early 1968.[58] He rightly observed: 'It is likely enough that camel, horse and ass were in fact all familiar features of the Indus caravans.' The caravans did indeed regularly cross the highlands of Gujarat and the lowlands of Sindh, Punjab and Rajasthan. In other words, the horse was widely domesticated and used in India during the third millennium BC over most of the area covered by the

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Indus-Sarasvatī Civilization. Archaeologically this is most significant since the evidence is widespread and not isolated. During the second millennium BC the presence of the horse at Pirak in Baluchistan is also well known.

Unfortunately, the horse has become a bone of contention between two groups of historians dealing with the 'Aryan Problem' in India, the so-called Nationalists and the so-called Marxists. The former, basing their views on the archaeological findings, maintain that the people of the Indus-Sarasvatī Civilization may have been the Vedic Aryans who are known in history for their chariots driven by horses, while the latter hold that the archaeological findings are 'minor', 'limited' and 'marginal', and hold onto the age-old view that the people of the Indus-Sarasvatī Civilization were not horse-users, hence could not be the Vedic Aryans. To say the least, this is a strange logic. For the scientists, Indus-Sarasvatī people were definitely horse-users, whether they were Vedic Aryans or not hardly concerns them. But Marshall certainly erred grossly when he observed that the Indus people could not be Vedic Aryan because they were not familiar with the horse, let alone its users. Incidentally, in the Vedas the people are never called *aśvārohīs*, i.e., horsemen, they are credited only with chariots driven by horses. They ate sheep, etc. but not horse meat or camel meat. Hence, it is not surprising that the horse and camel bones are only rarely found in excavations.

Recently Bhagwan Singh[59] has made a very plausible suggestion with regard to the process of domestication of the horse, on the basis of biosphere, Vedic references and archaeology. He starts with the observations made by Sandor Bokonyi in his letter dated 13 December 1991 to the Director-General, Archaeological Survey of India, M.C. Joshi.

(i) I can verify the supposition of A.K. Sharma concerning the occurrence of domestic horse in the site (Surkotada).

(ii) The occurrence of true horse (*Equus caballus* L.) was evidenced by the enamel pattern of the upper and lower cheek and teeth and by the size and form of incisors and phalanges [toe bones].

(iii) Since no wild horses lived in India in post-Pleistocene times, the domestic nature of the Surkotada horses is undoubtful. *This is also supported by an inter-maxilla fragment whose incisor tooth shows clear signs of crib biting, a bad habit only existing among domestic horses which are not extensively used for war.*

(iv) These horses were obviously imported from horse-domestication centers recently discovered in Soviet Central Asia whose distance was essentially shorter from India than from those in the Ukraine known source the mid-sixties.

(v) Since horse bones represent adult individuals, one can rightly suppose that the main exploitation of these horses was work (thus they were riding, pack or draught animals); nevertheless also their meat was eaten.

(vi) Besides horse bones, the overwhelming majority of equid remains are teeth and bones of the Khur, the Indian wild half-ass (*Equus hemianus* khur) that once lived in great numbers, and is still existing sporadically in Kacch.

Bhagwan Singh[60] then goes to put forward his own hypothesis:

We visualise three stages of use of equids by the Vedic Aryans or the Harappans. Firstly, they exploited the onager available in their surroundings. They called this beast *aśva* as it moved faster than the other animals known to them. At the second stage, in the course of their trade they came to know of the Kacch ass. At earlier stages they considered even the goat, *ajaśva*, and spotted deer, *prasadasva*, among the fast animals, the former being the vehicle of Agni and the latter that of the Maruts. At the third stage, when a more energetic breed, the steppe horse, was introduced, the appellation was transferred to it as it was faster than the ass. But it continued to be used for quite some time for the ass

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as well. *Aśvatara* stuck to its ground and continues to be used for mules in Sanskrit even today. It is notable that this cross-breed was considered sturdier than the 'horse' known to the 'horse-riding' Aryans. However, when *aśva* became an exclusive term for the horse, *khara, raśabha, gardabha,* etc. were affixed distinctively to the ass. It is interesting that *khara* (cf. *prakhara*) and *raśabha* (f. *sar/ras,* Eng. Rush, rash—onomatopoeic stems derived from the whizzing sound of wind and transferred to other fast-moving beings and things, including water) also refer to the speed of the animal.

'It appears that the Rann of Kacch with islands known for the wild ass (*Equus hamionus* Khur) was somewhat deeper during the Vedic or Harappan days and as such its ports were accessible through the naval route. R.S. Bisht... writes, 'Tradition has it that it was once an extension of the Arabian Sea and was utilised for maritime trade through its various ports perched along both its banks—the southern and northern. The ships of the renowned merchant Jagdu Sha, carrying gold and miscellaneous provisions, are said to be sailing from port to port in the Rann.'

The fact that the Vedic people imported the 'horse' from Kacch is supported by Vedic literature which is full of references to the *aśva* owing its birth to water or sea. *Uccaihśrava,* the *aśva* emerging from the churning of the sea of milk or *kṣīrasāgara,* is the ass found as a wild animal in Kacch. It may be pointed out that Khirsar was a port in Kacch and it has a mound of Harappan times (S.R. Rao 1991). It is all the more important for us that another name of Khirsar is 'Ghodewali wadi', the town (marketing centre) of horses (Rao 1991, 162).'

I am sure the book entitled *The Vedic Harappans* by Bhagwan Singh will be an eye-opener to all the archaeologists who have very little knowledge of Vedic Sanskrit and Vedic literature.

THE INDUS-SARASVATĪ CIVILIZATION AND THE VEDIC CULTURE: A REAPPRAISAL

Once it is clear that the Indus-Sarasvatī urbanism was a product of a developing culture-process of indigenous origin, we may return to our earlier issues and deal with a few specific issues, particularly those on the basis of which the Indus-Sarasvatī Civilization was once considered non-Vedic, a view which has now been found to be invalid.

The basic issue is the economic character of the Vedic society, as noted earlier. Undoubtedly, the source to reconstruct it is the Vedic literature itself. Bhagwan Singh has pursued this study. He used partly the linguistic approach and partly the contextual approach. The conclusions arrived at have indeed been startling. The economic character of the Vedic people has emerged as a strong combination of rural and urban elements and not just pastoral or agricultural pastoralism. The thrust of present-day arguments in favour of the theory of Vedic and Harappan or Indus-Sarasvatī identity rests on the major grounds set out below.

It is common knowledge that the Indus-Sarasvatī people or the Harappans were enterprising traders and that they had overseas contacts with the Persian Gulf countries like Oman, Bahrain, Failaka and Sumer since the Indus-Sarasvatī seals and sealings, pottery, beads, copper tools and ingots, weights of chert, etc., have been found at more than a dozen sites in these countries. Do we then get any reference to sea-trade in the Vedic literature, even though the Vedic seers may have been least concerned with these activities? The answer is in the affirmative; there are indeed several references to sea, (*samudra*), and traders (*paṇis*) engaged in sea-borne trade. *Navaḥ samudriyaḥ, sata-aritra* are among such terms which clearly indicate it. So much so that even piracy is mentioned. Fights on boats are mentioned. Attacks on boats laden with goods by unscrupulous people in order to capture them finds clear mention (ṚV. I. 36.18; 61; II; IV. 196). *Ugradeva, Navavastva, Bṛhadratha, Turviti,* the *Yadus* and *Vayya* had tough encounters with pirates, notes Singh.

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Trade with distant lands presupposes the emergence and consolidation of an internal trade-network. At Dholavira we have a signboard with 10 letters (Pl IX), obviously used for trading purposes. Does the Vedic literature throw some light on it? Yes, it does. Rivers, boats, goods on boats, movement of traders, monies and money transactions, including interest on loans, find ample references in the Vedic literature. Terms like *Vaṇika, Vaiśya, Vadinjaya, krinati,* etc. clearly show that trade, traders and monies did play their part in the everyday life of the Vedic people. References to *rathas* driven by horses, and carts driven by bulls, when seen in the light of terms used for fast-moving camels, donkeys, mules, etc. also establish the fact that the land routes were used by traders. This is not the place to go into details of sea-borne, river-borne and overland long-distance trade, with all the hazards involved in it, described in the Vedic literature, what is important to note here is that those who emphasize cattle-keeping as the only mode of economic life of the Aryan society dishonestly suppress the references which prove that the Vedas were quite clearly aware of the contemporary long-distance internal and external trade.

The Indus-Sarasvatī people are known for their variety of houses in cities. The question is whether the Vedic people were aware of such things. *Sarma, trivarutha sarma, sahasra-sthūna sarma, dhama, kṣaya, gṛha, sadana, vastu, vasati, durya, chardi, bhuvana,* are only a few of the terms they used for houses. This shows that a variety of houses were built in the Vedic settlements. Do the nomadic cattle-keepers make such a variety of houses in any part of the world? Perhaps, not. There are examples of all these types at Dholavira (Pls. X, XI and XII).

It is common knowledge that the *yajña-kuṇḍas* were built with bricks, both burnt and unburnt. We are made to believe, rightly observes Singh, that those 'who used the bricks in religious architecture did not use them in house-building'. Kosambi once observed in a most curious manner that parts of the Ṛgvedic *ṛcā* (122.13), where bricks are mentioned, must have been composed in Mesopotamia. 'In his view', further observes Singh, 'the cattle-keeping nomadic Vedic people should not be expected to use bricks.' Such curious arguments may have suited the Marxist historian in him but it does not suit an unbiased sober scholar of history. In the Brāhmaṇas, for example, the *Śatapatha* (1.2.22; 1.1.1-9), the term *iṣṭaka* for bricks has been used repeatedly. In fact, the people appear to be quite aware of cities as well as the adverse cultural effects of city life on human beings.

Once it becomes reasonably clear, as Bhagwan Singh has made out, that the Vedas do contain enough material which shows that the authors of the hymns were fully aware of cities, city life, long-distance overseas and overland trade using seals and sealings, such as at Dholavira (Pl. XIII), etc., which had characterized the Indus-Sarasvatī urban civilization, it becomes easier for us to appreciate the theory that the Indus-Sarasvatī and Vedic civilizations may have been just the two complimentary facets of one and the same civilization. And this, it is important to note, is not a proposition invalidating the cattle-keeping image of the Vedic Aryans. After all, all ancient civilizations had both the components, the village and the city, and numerically villages were many times more widespread than the cities. In India presently there are around 6.5 lakhs of villages but hardly 6000 towns and cities put together. If, therefore, during the Indus-Sarasvatī times there were more villages than cities and townships, it should not at all surprise us. Plainly, if the Vedic literature reflects primarily village life and not urban life, it does not at all shock us because the Vedic literature was primarily written for and written by hermits living in relative isolation which ambiance was generally to be preferred when offering prayers to the gods. In fact, for this very reason, the manner in which the *ṛṣis* told the story of trade and commerce, cities and city-life, etc. is not as direct as a Gazetteer might tell it; it is indirect, it is incidental, it is couched in simile. In other words, the Vedas are to be 'decoded' in a sense, and it is not difficult to do it. Scholars like Bhagwan Singh and Subhash Kak have done it in order to cull out the references which throw a flood of light on the real nature of the Vedic Aryan vis-a-vis Indus-Sarasvatī Civilization.

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The Myth of Massacre of Mohenjodaro and Aryan Invasion of the Indus-Sarasvatī Cities

'It seems better, as the evidence stands, to accept the identification and to suppose that the Harappans of the Indus Valley in their decadence, in or about seventeenth century BC, fell before the advancing Aryans in such fashion as the Vedic hymns proclaim.' —Mortimer Wheeler (1968:132)

Curiously enough, while propounding the theory of destruction of the Harappan or the Indus-Sarasvatī towns as well as the Indus-Sarasvatī towns as well as the the Indus-Sarasvatī Civilization by the invasion of the Aryans, Wheeler combined different kinds of evidence picked up selectively from different sites. Thus, he combined the evidence of skeletons found strewn in a disorderly manner in the streets and houses of Mohenjodaro with the so-called mud-brick defences of Harappa. Besides the fact that this is a faulty methodology, the theory of the defence and Aryan invasion could be conceived only in warlike activities and use of military weapons by the Indus-Sarasvatī people. And this has been highly questionable right from the time of Marshall (1931) who first proposed the invasion theory, though the invasion he had in mind was made by the Baluchi nomads and not by the Aryans. Wheeler himself had candidly admitted the absence of military outfits in Harappan towns (Wheeler, 1968:73). Still he suggested that small domed pieces of copper, each perforated with two holes, were sewn on to a garment and used as an equivalent of mail (Wheeler 1968:73), but there is no supporting evidence and neither body-armour nor helmets (well-known in Early Dynastic Sumer), nor indeed shields, can at present be attributed to the Indus-Sarasvatī people.

He further states (Wheeler 1968:72) that it is 'true, the military element does not loom large amongst the extant remains, but it must be remembered that at present we know almost nothing of the civilization.' In fact the implements of copper found so far in the Indus-Sarasvatī towns are, by and large, domestic in nature. Moreover, where are the remnants of the weapons of war supposed to have been used by the invading Aryans? Can their absence be justified in the case of the invaders as well? Similarly, if the invasion by the Aryans was the cause of the destruction of the Indus-Sarasvatī culture, where are the remains of the Aryans at the Indus-Sarasvatī sites? The Aryans cannot be said to have destroyed the Indus-Sarasvatī people simply in a fit of temper or for the sake of pleasure. The onslaught must have had a certain aim behind it and the principal aim of an invader is generally loot or the occupation of the site, at least temporarily. The Aryans cannot be believed to have been interested only in collecting booty from various places and abandoning the sites when it is clear from the early Vedic literature that the *saptasindhu* or the Punjab-Haryana region was their homeland. Indications of people, other than the Indus-Sarasvatī people, occupying the same site immediately after its destruction, in an almost overlapping manner, are not available from the sites representing the mature Indus-Sarasvatī culture; even the Cemetery 'H' complex at Harappa was separated from the Harappan levels by more than a metre and a half of deposit of debris (Wheeler: 1947:84) which of course, is only partially true. Dales (1964:38) is, therefore, right in raising some of the following most pertinent questions:

"Where are the burned fortresses, the arrow-heads, weapons, pieces of armour, the smashed chariots and bodies of the invaders and defenders? Despite the extensive excavations at the largest Harappan sites, there is not a single bit of evidence that can be brought forth as unconditional proof of an armed conquest and the destruction on the supposed scale of the Aryan invasion."

This brings us to the 'massacre' of people at Mohenjodaro, since, as said at the outset, Wheeler combined the supposed evidence of the destruction of fortifications with the skeletons found spread helter-skelter at this site (Pl. VIII). Wheeler (1968:129) himself was not sure if the evidence was sound since he clearly states that, 'unfortunately, the older excavations did not record stratification with any regard to precision, and in the absence of precise record it cannot be affirmed without shadow of doubt that the skeletal remains were

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not contemporary.' That all the skeletal remains were not contemporary to each other as the product of a single tragedy had been conclusively proved by Dales (1964), at least four years before Wheeler reluctantly accepted the position.

What of these skeletal remains that have taken on such undeserved importance? Nine years of extensive excavations at Mohenjo-daro (1922-31)—a city about three miles in circuit—yielded the total of some 37 skeletons, or parts thereof, that can be attributed with some certainty to the period of the Indus civilization. Some of these were found in contorted positions and groupings that suggest anything but orderly burials. Many are either disarticulated or incomplete. They were all found in the area of the Lower Town—probably the residential district. Not a single body was found within the area of the fortified citadel where one could reasonably expect the final defence of this thriving capital city to have been made.

As Dales commented, 'It would be foolish to assert that the scattered skeletal remains represent an orderly state of affairs, since there is no conclusive proof that they even belong to the same period of a single tragedy.'

The fact of the matter is that, except for two, no skeleton bears marks of cut by a sharp-edged weapon and close examination of the two cases of cut marks by Professor K.A.R. Kennedy has shown that the wounds were completely healed, a process which takes around three months time. Clearly enough, no one died in a warlike situation as visualized by Wheeler.

So much about the myth of 'massacre at Mohenjodaro'. But then how to explain the evidence of skeletons found in its streets. Simple enough. They were the victims of repeated floods which the city experienced from the Indus. They belonged to different periods of time and they are found embedded in silt and clay.

Artisans and Their Craft-Specialization's in Vedic Society

"That the artisans enjoyed a respectable position in the Vedic society is clear from the deification on some of the professions:

Aśvins	—	surgeon, charioteer, sailor.
Uśa/Urvaśi	—	dancer.
Ṛbhus	—	fabricator, seal maker.
Tvasta	—	carpenter, fabricator.
Pusa	—	guard, guide.
Agni/Brāhmaṇaspati	—	priest.
Maruts	—	peasants, miners, traders, warriors.
Rūdra	—	therapist, physician.
Varuṇa	—	navigator.
Vāstospati	—	architect, mason.
Viśvakarmā	—	carpenter, architect.
Viśvarūpa	—	potter, fabricator.
Sarasvatī	—	artist, poet.
Sinivali	—	entertainer.

These artists and professionals are not only praised as *satyamantra*—one whose words are true, *vistvi*—innovative, *sami*—laborious, *suracakṣas*—far/sharp-sighted, and *vidmanapas*—skillful artisans, but there are also clear suggestions in ṚV that despite their low position in the social order, they had a special status which evoked respect.[61]

These craftsmen are appreciated time and again for their wondrous command over the crafts which produced marketable goods and therefore fetched huge profits.[62] It is not due to liberal attitude of the Vedic people but due to the material conditions prevailing in those days. If a society advances in the field of science and technology, specialists enjoy a respectable

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position due to greater emphasis on quality and quick supply of demands. As a result, demand for highly skilled artisans increases in the society. When there is a setback they suffer accordingly, both socially and economically. So we do not feel surprised to find the Aśvins and the Ṛbhus being offered *Soma* with Maruts and Indra for they are adding to the prosperity of their clients.[63] But as *pañcajanas* or *pañcākrstis* they are mentioned almost without the passion visible in the case of Ṛbhus and Aśvins and Tvasta, reminding of equally rhetorical references of saptasindhavaḥ or the seven rivers in contrast to verses on Sarasvatī, Sindhu, Vipāsā and Sutudri. However, doubt may not be cast on diversification of human endeavours and specialization of crafts with a long history and enviable competence. We know how exquisite most of the Harappan products are. But if we have a look at the words of appreciation showered on them in the *Ṛgveda* we are amazed to find that the quality of Harappan products and the words of admiration in the *Ṛgveda* match perfectly.

Ṛgvedic language has a rich vocabulary evolved in the course of technical development and appreciation of art work. We come across scores of words in extra-industrial contexts which derive their significance from the qualities and defects of such products. Even a cursory glance at this terminology is sufficient to convince that the artisans and their clients were meticulous in taking note of the minutest flaws in the articles produced, sold and purchased:

akertaruk (X.84.4) — possessing unimpaired splendour, showing no scratch.
aketu (I.6.3) — shapeless, unrecognizable.
akharva (VII.32.13) — not shortened or mutilated.
agnibhrajas (V.54.11) — possessing fiery splendour.
agniśriyaḥ (III.26.5) — having the brightness of Agni.
atirocamana (X.51.3) — surpassing others in shine/polish.
atividdha (VII.96.2) — pierced or drilled badly.
atisarp (VIII.102.21) — to pass through.
anva (IX.10.5; 91.3) — fine interstice or hole.
anvi (IX.1.7) — pierced.
anvya (IX.14.6; 15.1; 26.1) — penetrable.
ataptatanu (IX.83.1) — unfired, unbaked.
atrdila (X.94.11) — having no interstices.
adabdhadhiti (VI.51.3) — whose works are unimpaired.
adbhuta kratu (VIII.23.8) — possessing wonderful intelligence.
adhivikartana (X.85.35) — the act of cutting off or cutting asunder.
anabhimlata varṇa (II.35.13) — unfaded colour or brightness, glaze.
anabhisasta (IX.88.7) — blameless, faultless.
anavadyarūpa (I.123.8; II.27.2) — of faultless shape, form.
anavadyarūpa (I.152.4) — not united but spreading all around.
anaviddha (VI.75.1) — uninjured, unpierced.
arepa (V.53.3; 63.6; X.78.1) — spotless.
aśreman (III.29.13; X.8.2) — faultless, perfect.
akṛta (VIII.10.1) — arranged, built.
ākṛti (X.85.5) — constituent part, shape, form.
atrda (VIII.1.12) — to divide, pierce.
ama (III.30.14; IV.3.9) — unbaked, unannealed.
aripra (VII.47.1; 90.4; X.120.9) — plain, unslipped, pure clean.
krtnu (I.92.10; VI.18.5) — artificer, mechanic.
kṛtṛma (II.15.8; VIII.21.3) — artificial.
komya (I.171.3) — polished.

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cakṣma (II.24.9)	—	graceful, appealing.
caru (I.24.1; II.27.8; V.3.3)	—	beautiful, agreeable.
tridila (X.94.11)	—	pierced, porous.
tridhātu (I.34.6; III.26.7; IV.42.4)	—	alloy (bronze) made of three metals.
trivartu (VII.101.2)	—	three fold.
trivisti dhatu (I.102.8)	—	alloy.
prama (X.130.3)	—	measure, estimate.
mlata (VIII.55.3)	—	tanned.
mrda (VI.53.3)	—	soft.
randhra (VIII.7.26)	—	hole, aperture.
ripa (II.32.2; X.79.3)	—	to smear, to adhere to.
ripta (I.162.9)	—	smeared.
ripra from p.122	—	dirt, impurity.
ripravaha (X.16.9)	—	removing impurity.
vivartana (I.162.14)	—	revolution.
vidujambha (III.29.13)	—	strong teethed.
sukrta (I.35.11)	—	well made.
sri (IX.71.4; X.61.3)	—	to mix, shuffle.

Passing through such words we are regularly reminded of the care and skill of Indus-Sarasvatī artisans, of the shape, lustre and polish of their ceramic wares and seals, of the fine drilling of the beads, and of the perfect fixture of their chariots and boats. Now we may examine some of the areas of expertise.

The most important development in transition from Neolithic to Chalcolithic was the introduction of metals. It transformed the primitive agricultural subsistence pattern into advanced agriculture with animal power for traction and metal related trade-cum-industrial network. This again lead to emergence of procurement-cum-distribution centres with concomitant developments culminating in urbanization. In the Neolithic society there was hardly any space for whole time craft specialisation as there was nothing which everyone could not do reasonably well. But with the introduction of metallurgy, no society could survive without a section of it devoting itself entirely to mining, smelting and transporting the ore and followed by other sections engaged in making tools, implements and ornaments. Specialization became more pronounced with non-availability of mineral ore nearby. Thus division of labour and professional expertise." *(After Bhagwan Singh).*

ACKNOWLEDGEMENTS

I owe thanks to Shri Ashwani Asthana, Research Officer, Indian Archeological Society, for many drawings, details of some sites and overall assistance he rendered in preparing the manuscript. Shri M.S. Mani and Shri Rakesh of the same Society made many drawings and typed the manuscript, respectively, for which I owe thanks to them also. For Dholavira illustrations and excavation-details I thank Shri R.S. Bisht, the excavator, and the courtesy Archeological Survey of India, where he is Director.

I owe special thanks to my friend Shri Bhagwan Singh from whose book *The Vedic Harappans* I have drawn the entire portion dealing with Vedic references in which crafts and artisans have been mentioned, a fact which goes a long way to prove that the Vedic and the Harappan or the Indus-Sarasvatī Civilization may not have been far removed from each other. Similarly, I owe a sense of gratitude to Prof. B.B. Lal from whose book *India 1947: 97: New lights*

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on the Indus Civilization I have quoted extensively in the context of authorship of the Indus-Sarasvatī.

Lastly, I will fail in my duty if I do not dedicate this write-up to Dr. Shashi Asthana who died in September, 1997, before it is finalised for print because she helped most in the preparation of the manuscript and detailed discussions on many theoretical issues with great passion and greater insight.

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APPENDIX I

Water Management and Conservation Planning At Dholavira: Indus-Sarasvatī City

"Even a drop of rain water was conserved"

The ancient site of Dholavira, (23° 53′ 10′N Lat., 70° 13′ E Long.) is located at north-western corner of Khadir Bet, a km north-west of the village Dholavira in the Great Rann of Kutch. The site falls in the Bhachau Tehsil, District Kutch of Gujarat State. The site is one of the earliest and largest urbanised Indus-Sarasvatī city centre on the western frontiers of Indian sub-continent. The site Dholavira locally known as Kotada and Bazaar was discovered by Shri J.P. Joshi in 1967-68.

The scientific excavation of the site started in 1989-90 field season and is still in progress through 1997-98. The Director of the excavation is Shri R.S. Bisht, Director, Archaeological Survey of India and his team members, including the author. The excavations have brought out some fresh and unique aspects in the field of Indus-Sarasvatī studies such as:

1. The ten signs of Indus-Sarasvatī script probably inlaid in a wooden plank with each letter measuring 33 cm (height) × 27 cm (breadth). There is one more large sized inscription.
2. The social stratification of a Harappan society, i.e., appearance of triple mound.
3. Dholavira as a hub of trade and commerce.
4. A unique Hydel engineering planning, i.e., Water management, Conservation, Damming and Drainage system.
5. Dholavira as a centre of stone fabrication.
6. Continuous growth and decadence of Indus-Sarasvatī Urban Culture (3000 BC to 1500 BC).
7. Sophisticated and Systematic Gateways.
8. Evidence of a Stadium during Mature Indus-Sarasvatī times.
9. Expansion and contraction of the city population in Grid pattern, in time and space.
10. A unique mathematical ratio and proportion adopted in laying out the city.
11. Variety of funerary structures.

It is well known fact that the ecology has direct bearing on the pattern of settlement planning. At Dholavira this phenomena can be seen in much preserved form.

In an era of vast expansion due to present role of urbanisation, it is of immense revelation to the present time that, how the people of Dholavira derived such unique systems and methods of water conservation. There are ways to conserve such traditional methods which may be employed in the present time.

Climate

The present climate of Dholavira is arid to semi-arid. There is, however, no available source of surface water other than the artificial lakes and ponds, which too are totally dependent on the monsoon. This area has good ground reserves. The soil is rich and fertile sandy loam, but not available in plentiful for cultivation. This region is the second poorest in Kutch in respect of the rain fall which averages about not more than 262 mm per year. Monsoon remains active from June-August some times extending to September also. The *Kharif* is the main crop. The failure of the monsoon, for three years to five years consecutively, and frequently results in lack of both ground and surface water, causing large scale temporary migration with their live stocks to better pastures. Thus land has almost an uncongenial environment for human occupation. If this situation is projected backward the climate of ancient

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Dholavira might not have been much different. And now this assumption poses a question as to how such a big settlement lived, survived and prospered over the centuries.

The answer for this would be to find out and assess how the Dholaviran's managed with their meagre supply of water resources.

Management and Conservation Planning

It is common knowledge that the Indus-Sarasvatī architects were quite familiar with the science of hydel engineering which could not have been acquired over night. At Dholavira this has been at *par excellence*, for the first time in the field of Harappan studies the excavations at Dholavira have added a fresh chapter in the studies of water management during Mature Indus-Sarasvatī times. Such as damming the rivers, rock-cut reservoir, structural reservoir associated with well, systematic drainage network for regulating the rain water from water chutes to reservoirs, besides creating artificial lakes and ponds. The layout of the city is one of the best examples of utilization of natural topography with a view to manage and conserve each and every drop of rain water falling in the city for their day-to-day need. The city is carefully laid out between the two seasonal rivers, Manhar and Mansar, running one km apart from each other almost adjacent to the northern and southern fortification wall on the outside. The catchment area of the water for the reservoirs etc. is approximately 10-12 km east to the site, 100 to 150 metres high rocky hills of late Jurassic period on the eastern boundary of the Khadir Bet. The seasonal rivers, Manhar and Mansar discharging their water, merges into the great Rann of Kutch at a distance of 5 to 6 km west of the site.

The measurement of city planning at a glance are tabulated below:

S. No.	*Division*	*length in metres(L)*	*Breadth in metres (B)*	*L:B Ratio*
1.	Inner Measurement of the City	771.10	616.85	5:4
2.	Inner Measurement of Castle	114.00	92.00	5:4
3.	Outer Measurement of Castle	151.00	118.00	5:4
4.	Outer Measurement of Citadel (Including Bailey)	280.00	140.00	2:1
5.	Inner Measurement of Bailey	120.00	120.00	1:1
6.	Inner Measurement of Middle town (including ceremonial ground)	340.50	290.45	7:6
7.	Inner Measurement of Middle town (excluding ceremonial ground)	340.50	242.00	7:5
8.	Inner Measurement of Ceremonial ground	295.00	48.00	25:4
9.	Built up area of Lower town	330.00	300.00	11:10
10.	Total area covered by the reservoir is 1,30,500 sq mts			

Dams

The average gradient of the river Manhar and Mansar from the foot of the hill to the site is 30 to 40 mt i.e., 3 to 4 mt per km. The velocity of gushing rain water of the river to the site is very high. To avoid any damages to the structural dams, the Dholaviran's erected stone boulder barriers or obstacles in the river, almost at regular interval of distances 90 to 100 mt or so, to break and check the velocity of water, there is a clear evidence that the boulders in groups are of different Geological formation than that of the river and the site. By means of dressed stone blocks and by dressing of standing rock faces, the dam walls were raised/erected in the river to divert the water into the fortified area of the city, from south-eastern and north-western corners of the city, from where the water is fed into 4 to 6 mt wide walled reservoirs, constructed in series on the three sides of the city within the fortified area in a spill-way channelling method.

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The dam on the river Mansar used to feed the reservoirs of the northern side whereas river Manhar was feeding the reservoirs on the southern and western side of the city. The evidence shows that the rain water of Middle town was discharged into the reservoirs on the western side through a water gate, built in the western fortification arm of the Middle town. In addition to these there is an another dam 200 mt north-west of the north-western corner of the city. This dam was meant for diverting the escaped flood water to feed a 1,50,000 sq. mt large pond lying 200 to 300 mts westward of the city. The water collected was probably meant to be used for agricultural purposes. Whereas in the similar technique the escaped or over flooded water of river Manhar was made to feed a 2,00,000 sq. mt (approximate) large pond adjacent to the cemetery area which is 345 mt south-west of the city fortified area.

Reservoirs

To regulate and conserve the rainwater diverted from the river Manhar and Mansar, rectangular reservoirs in series were constructed within the fortified area of the city. To reduce the surface area of the reservoirs, so as to keep control over the excess of evaporation and also to minimise the pressure of the water thrust exerting on the walls of the reservoirs. The total approximate area covered by the reservoirs is 1,30,500 sq. mt which is approximately 28% of the total fortified area of the city. The maximum average depth is 1.30 to 2 mt, hence the volume of the water collected in its full capacity was approximately 2,61,000 cubic mt (excluding Bailey area reservoir which is 12,400 cubic mt).

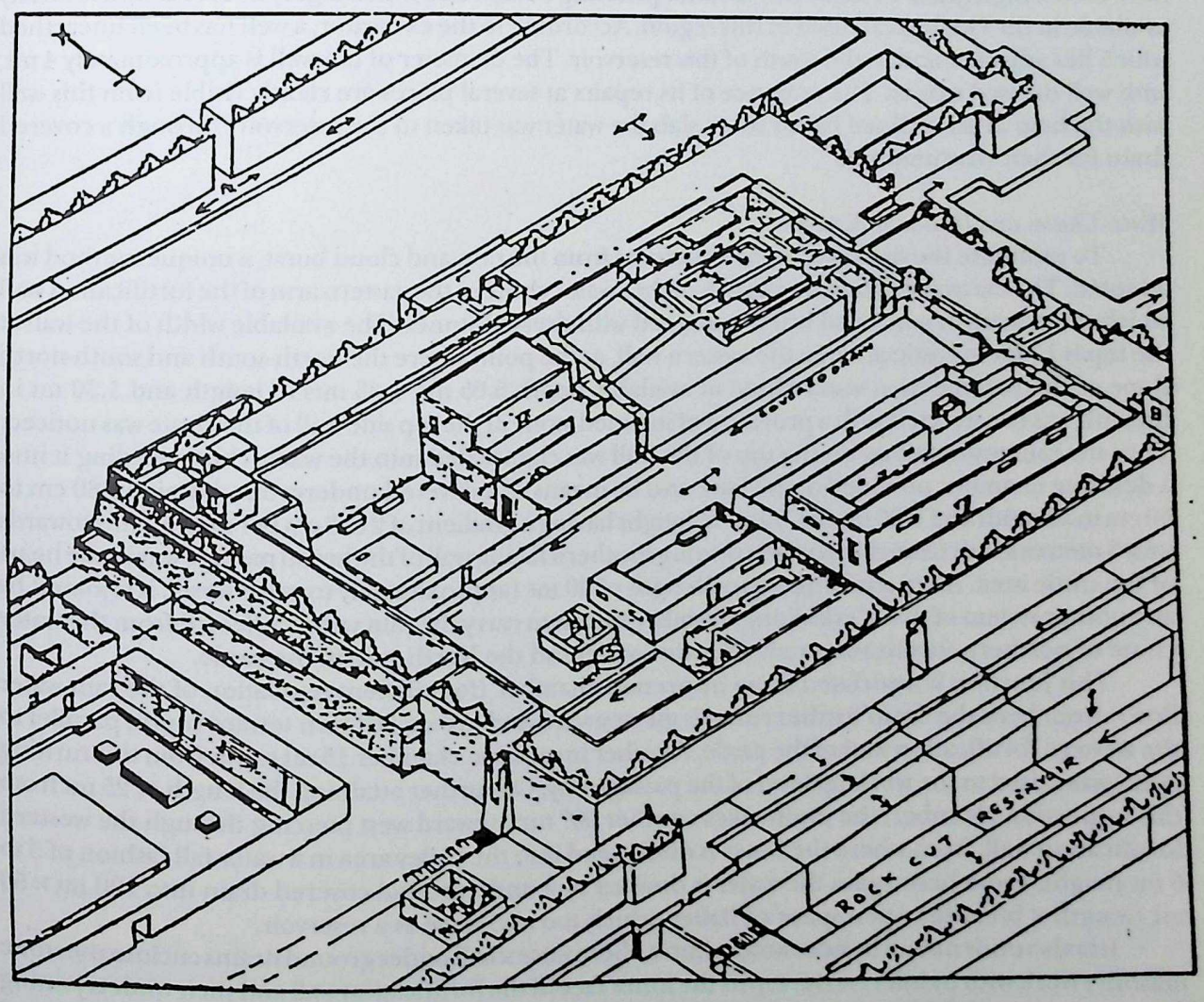

Fig. 57: Conjectural view of the Castle Area Water Management and Conservation planning at Dholavira.

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The partition spill channel walls are 4 to 5.50 mt broad, made up of sun dried mud bricks veneered with stone masonry on either face of the wall. The outer city fortification also serves as an arm of the reservoir, it is 5 to 6 mt at some places, 7 mt broad made up of sun dried mud bricks veneered with dressed stones with tapering faces on either sides The bed rock serves as the base of the reservoir. According to the excavator in the current field, seasons excavation, in one of the reservoirs south of the castle, a stepped trough like structure cut into the bed rock 7.5 mt deep, 12.5 mt wide and its full length not yet exposed was unearthed. It is, therefore, more interesting to note that the base level of the rock cut in reservoir was dug by the Dholaviran's much deeper than the present base level of Manhar river, probably to make the best use of sub soil water in form of a well, the water collected from the veins and cavities of the rocks. Therefore, even after the full consumption of dammed water this stepped well like structure was sufficient enough to meet the day-to-day need of the people there.

The excavations in castle area have brought to light reservoir associated with a well, which lies in the south-western quarter half area of the castle, the reservoir with a provision of seven steps starting from half of its depth, having a required volume of 18.8048 cubic mt, the base is made up of horizontally paved stone slabs with small desilting chamber almost at the centre of the reservoir measuring 80 cms × 65 cm × 70 cm (approximately, length × breadth × depth). The basal course of the side walls of the reservoir is veneered by vertically erected stone slabs 1.20 mt in length and 45 to 75 cm in breadth, over which the wall of dressed stone is raised. The technique of water proofing as evident from Mohenjodaro's Great Bath and Lothal's Dock yard by applying bitumen, at Dholavira in this reservoir the people here have used a high grade of sticky clay as water proofing compound which is grey in colour and is locally available in the Geological strata of this region. According to the excavator, a well has been unearthed which lies adjacent and to the south of this reservoir. The diameter of the well is approximately 4 mt. with well dressed stones. The evidence of its repairs at several places are clearly visible from this well with the help of an inclined broad stone slab the water was taken to the reservoirs through a covered drain for their consumption.

Water Chutes and Drainage Network

To minimise the damages to the structures from the rain and cloud burst, a unique method was adopted. The excavations have brought to light a water chute in the eastern arm of the fortification wall which is made up of sun dried bricks veneered with dressed stones. The available width of the wall at the top is 17 mt in castle area. In the eastern wall, at the point where the north-south and south-north slope of the wall meets, a water chute of available depth 5.65 mt, 1.85 mts in length and 1.30 mt in breadth was constructed with a provision of inclined stone at the top side wall of the chute was noticed. Thus the rain water falling on the top of the wall was channelled into the water chute, leading it into a desilting chamber provided at the base and by means of a covered underground drain of 80 cm to 50 cm in breadth and 1.90 mt to 1.50 mt in height having a gradient of 2 to 3 cm per metre, runs towards west 3 metres south from the parallel running southern facing wall of the broad passage way in the heart of the castle area. After attaining a good length of 40 mt (approximately towards west), it is joined by an another system of drain's desilting chamber meant to carry the rain water collected from the water chute of northern fortification wall side, almost behind the North gate in the castle.

This junction is associated by an inspection chamber (for efficient regulation of the rain water flow), from here the drain further runs 75 mt westward and takes a 90° turn toward south, parallel to the western fortification wall of the castle. Another inspection chamber 15 mt south from this turning point was raised to the working level of the passage way. On further attaining the length of 25 mt from this inspection chamber, the drain takes another 90° turn toward west piercing through the western fortification wall, from where the water is discharged into the bailey area in a water fall fashion of 5 to 6 mt height. From here again the water is drained by a underground covered drain into 120 mt × 50 mt (length × breadth) open space of Bailey, which too also serve as a reservoir.

It is also evident that besides water chutes, there were small under ground drains cut into the stone masonry work with its inlet on the top of the inner face of the fortification wall and their outlets joining the main-covered drain of water chutes network in castle. Apart from such highly sophisticated drainage network, exclusively meant for the rain water regulation, there are ample evidences to show

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that the Harappans at Dholavira were very hygiene conscious people, they were draining out their sewage water by means of carved out stone and terracotta drains with their outlets discharging into the terracotta soakage jars, pits, troughs and stone soakage chambers covered with capstone slabs.

Today, if we try to reconstruct a conjectural view of ancient Dholavira, it appears that during its hey days it would have looked like a "Water Fort".

New Discoveries at Dholavira

In the recent most excavations conducted in 1998 at Dholavira R.S. Bisht and his colleagues have discovered an ancient dam across the seasonal river Manhar with 32 steps of stone rubble leading to the top of it. Another significant discovery is a reservoir lined with stone masonry, outside the eastern gate of the citadel.

Thus, Dholavira presents a feature of water-management in an arid area the like of which has been found nowhere else.

(After Ashwani Asthana)

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APPENDIX II

Relevant corrected radiocarbon dates determining the chronological bracket of the Indus-Sarasvatī Civilization

Early Phase of the Indus-Sarasvatī Civilization (3500-2800 BC)

Sites	*Sample No.*	*Radiocarbon dates (5730 Half-life)*	*Calibrated Dates*
1	2	3	4
Damb Sadaat (Pd.II) Charcoal	L 180 E	2550 ± 370 BC	3021, 2916, 2927 cal. BC
Gumla (Pd. II)		2385 ± 155 BC	2883, 2796, 2784 cal. BC
Hathial West (Late Kot Diji)	BM-1949 R	2150 ± 145 bc	2554, 2548 2491, cal. BC
Harappa	BETA-33783 Hearth, Charcoal	2725 ± 90 bc	3338, 3213 3203 cal. bc
Harappa	BETA-33874	2725 ± 185 bc	3338, 3213 3203 cal. bc
Ghazi Shah (Amri/Harappan Transition)	BETA-33358 Charcoal	2325 ± 70 bc	2867, 2808 2772, 2723 2699 cal. bc
Gonur Depe North (Namazga V, Harappan)	BETA-33558	2540 ± 60 bc	3018, 3001 2926 cal. bc
Hulas	PRL-1032 Charcoal	2560 ± 155 bc	3028, 2985 2930 cal. bc
Islam Chowki	OKA-1005	2335 ± 105 bc	2870, 2806, 2774, 2720, 2702 cal. bc
Jhang	BM-2201 R Charcoal	2440 ± 115 bc	2903 cal. bc
Jhukar	P-2476 Charcoal	2820 ± 310 bc	3371 cal. bc
Jodhpura (Ganeshwar culture)	PRL-275 Charcoal	2540 ± 165 bc	3018, 3001, 2926 cal. bc
Kalibangan	TF-241 Charcoal	2265 ± 95 bc	2853, 2882, 2655, 2644, 2615 cal. bc
Kalibangan	TF-155 Charcoal	2370 ± 120 bc	2879, 2799, 2781, 2711, 2709 cal. bc
Kot Diji	P-196 Charcoal	2605 ± 145 bc	3070, 3040, 2781, 2711, 2709 cal. bc

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1	2	3	4
Kot Diji	P-180 Charcoal	2255 ± 140 bc	2851, 2830, 2653 cal. bc
Kot Diji	P-179 Ash and Charcoal	2335 ± 155 bc	2870, 2806, 2720, 2702, cal. bc
Kunal	BETA-77727 Charcoal	2430 ± 135 bc	3628 cal. bc
Lak Largai	BM-2402 Charcoal	2345 ± 50 bc	2872, 2804, 2776, 2717, 2704 cal. bc
Loteshwar (Pd.II)	PRL-1565 Charcoal	3100 ± 110 bc	3698 cal. bc
Mehrgarh (Pd.IV)	LY-1528 Charcoal	2365 ± 145 bc	2877, 2800, 2780, 2712, 2708 cal. bc
Mundigak (Pd. III 5)	GSY-53 Charcoal	2360 ± 155 bc	2876, 2801, 2779, 2714, 2707 cal bc
Padri	PRL-1787	3010 ± 100 bc	3680 cal. bc
Prabhas Patan (Pd.I)	PRL-90 Charcoal	2415 ± 115 bc	2892 cal. bc
Rana Ghundai (Pd. III) (Pd. III Archaeology)	P-2149 Burnt seeds	2790 ± 60 bc	3360 cal. bc
Rehman Dheri (Pd. II, Kot Diji)	WIS-1699	2355 ± 70 bc	2875, 2802, 2778, 2715, 2706 cal. bc
Rehman Dheri (Pd. II, Kechi Beg)	PRL-676 Charcoal	2705 ± 115 bc	331, 3226, 3185, 3155, 3147 cal. bc
Sarai Khola (Pd. II A)	BM-1936 R Charcoal	2295 ± 255 bc	2860, 2817, 2693, 2684, 2662, 2633, 2626 cal. bc
Sarai Khola (Pd. II A)	BM-1944 R Charcoal	2450 ± 255 bc	3334, 3219, 3189, 3152, 3148 cal. bc
Sarai Khola (Pd. II A)	BM-1942 R Charcoal	2305 ± 125 bc	2862, 2814, 2738, 2728, 2695, 2679, 2665, 2630 cal. bc
Surkotada (Pd. I. A Mid levels)	PRL-85	2315 ± 135 bc	2865, 2810, 2747, 2725, 2697, 2674, 2668, cal. bc
Mature Phase of the Indus-Saraswati Civilization (2600-1900 BC). (The Period between 2800 BC and 2600 BC was the transition period)			
Harappa (Transition Early/Mature)	WIS-2142 Carbonised Wood	2316 ± 65 bc	2863, 2812, 2742, 2776, 2696, 2677, 2666 cal. bc
Harappa (Mature)	WIS-2140 Charcoal	2470 ± 70 bc	2913 cal. bc
Kalibangan (Mature)	TF-942 Charcoal	2225 ± 115 bc	2586 cal. bc

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1	2	3	4
Kalibangan (Mature)	TF-152 (BS) Charcoal	1725 ± 130 bc	1923 cal. bc
Kalibangan (Mature)	TF-138 Charcoal	1215 ± 105 bc	1391, 1334, 1327 cal. bc
Lothal (Mature)	TF-136 Charcoal	2080 ± 135 bc	2461 cal. bc
Lothal (Mature)	TF-135 Charcoal	1555 ± 130 bc	1735, 1717, 1701 cal. bc
Mohenjodaro (Mature)	P-1177 Charcoal	2155 ± 65 bc	2556, 2546, 2493 cal. bc
Mohenjodaro (Late Mature)	TF-75 Charred grains	1760 ± 115 bc	1961 cal. bc
Pirak (Pd.I)	LY-1641	2250 ± 300 bc	2250, 2245, 2652, 2647 bc
Rehman Dheri (Pd. III; early/mature)	BM-2062 R Charcoal	2130 ± 115 bc	2470.bc
Rojdi (Mature)	PRL-1091 Charcoal	2325 ± 115 bc	2867, 2535, 2506 cal. bc
Rojdi (Mature)	PRL-1085 Charcoal	2190 ± 115 bc	2573, 2535, 2506 cal. bc
Shortugai (Pd.I, Mature)	NY-425 Charcoal	2210 ± 105 bc	2580 cal. bc
Shortugai (Pd.I, Mature)	NY-430 Charcoal	2245 ± 100 bc	2651, 2649, 2610 cal. bc
Late and Final Phases of the Indus-Saraswati Civilization (1900-1400 BC)			
Daimabad (post-urban)	PRL-426 Charcoal	1760 ± 155 bc	1961 cal. bc
Daimabad (post-urban Pd. II)	PRL-657	1285 ± 105 bc	1424 cal. bc
Daimabad (post-urban Pd. III)	BS-182	1275 ± 95 bc	1420 cal. bc
Kalibangan	TF-138	1215 ± 105 bc	1391, 1334, 1327 cal. bc
Kalibangan	TF-152 Charcoal	1725 ± 130 bc	1923 cal. bc
Katelai (Late Bronze/ Early Iron)	R-476 Burnt Human bones	1295 ± 155 bc	1428 cal. bc
Loebnar III (Pd. IV, Chalcolithic)	P-2584 Charcoal	1285 ± 60 bc	1424 cal. bc
Mohenjodaro (Late Mature)	TF-75 Charred grains	1760 ± 115 bc	1961 cal. bc
Nausharo (Mature)	BETA-18843	2540 ± 70 bc	2598 cal. bc
Prabhas Patan (Late, LRW)	PRL-19 Charcoal	1245 ± 165 bc	1406 cal. bc

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1	2	3	4
Rojdi (Mature)	TF-199 Charcoal	1750 ± 105 bc	1947 cal. bc
Sibri (Pd. VIII C or later)	BETA-26	1365 ± 60 bc	1514 cal. bc
Shortugai (Pd. III post-urban)	NY-424	1325 ± 345 bc	1445 cal. bc

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APPENDIX III

Mehrgarh Cultural Sequence

Mehrgarh I: Aceramic Neolitllic settlement—seventh Millennium BC; Area—MR 3; Mud-brick Structures; Graves—flexed and extended human burials; Clay figurincs—human and animals; Agriculture—wheat, barley, jujube; Domcstication of animals—sheep, goat and cattle; Beads—turquoise, lapis lazuli, shell, one copper bead; Lithic artefacts—microliths and polished axes.

Mehrgarh II: Ceramic Neolithic settlement—fifth Millennium BC; Area—MR 4; Elaborate structures; Granary; Handmade and wheel-turned wares painted with geometric motifs; straw tempered handmade ware; Human figurines; Bead work—specialized crafts-workshop, flint drills; Copper ring, copper bead, Lapis lazuli, turquoise, shell beads; Lithic artefacts—sickle; Agriculture-addition to cotton

Mehrgarh III: Early Chalcolithic settlement—First half of the fourth Millennium BC. Area MR 2. Compartmented structures—larger and more elaborate. Tcchnological innovtions—introduction of metallurgy, crucibles with molten metal, first appearance of double spiral headed pin. Pottery—wheel-turned wares with painted caprids, birds and geometrical motifs. Figurines. Development of craft—jasper drill-bits, use of lapis, turquoise, carnelian. Agriculture—two new bread wheats, oats.

Mehrgarh IV: Advanced Chalcolithic settlement—Middle of the fourth Millennium BC. Area MR 1. Elaborate structures. Technological development. Ceramics—wheel turned potteries with monochrome and polychrome geometric decorations, Togau ware. Terracotta female figurines. Amulet. First appearance of stamp seals, bone seal.

Mehrgarh V: Transition—Third quarter of the fourth Millennium BC. Area MR 1. Potteries—paintings with white pigment, monochrome potteries with geometric motits. Human figurines. First appearance of grey ware. Togau D Ware.

Mehrgarh VI: Early Bronze Age settlement (towns)—End of fourth Millennium BC. and beginning of the third Millennium BC. Elaborate structures. Production of pottery in Area MR 1 on mass scale. Pottery—regional distribution. Ceramics—Black-on-grey ware, Quetta ware, Nal polychrome ware, red ware with painted leaves. Compartmented stamp seals, use of lapis lazuli, turquoise, copper, etc. Agriculture—addition of wine grape.

Mehrgarh VII: Advanced Bronze Age settlement (cities)—Middle of the third millennium BC. Area MR 1. Monumental platform. Pottery—Black-on-grey ware, Late Quetta style, a few Kot Dijian style pot-sherds. Mass production of male and female figurines, Zhob Mothergoddess. Zebu figure. Terracotta cakes. Copper objects—double spiral headed pin. Alabaster ram, lapis, turquoise, stamp seals.

(After J.F. Jarrige)

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APPENDIX IV

Harappa 1991: Preliminary Periodization

Period	*Area of Mound*	*Description*
1	Mound E northwestern corner	Early Harappan Initial settelment on natural plain surface
2	Mound E western half	Early Harappan massive mud-brick revetment walls, gradual transition to Period 3
3A	Mound E, Area J, Mound F	Harappan baked brick architecture, square intaglio seals terracotta bull figurines (legs joined), painted pottery (black on red slip)
3B	All areas of site, including modern Harappa town	Harappan baked brick architecture, square intaglio seals steatite and faience tokens, terracotta bull figurines (legs separated),
3C	All areas of site, including modern Harappa town	Harappan baked brick architecture, square intaglio seals fewer steatite and faience tokens, pointed base goblets (final levels)
4	Mound E	Transitional phase prior to phase 5
5	Mound E, Mound AB, Area H, part of Mound F	Late Harappan Cemetry H style ceramics and artifacts
Early Historic	Mound AB	Gupta period sculpture, etc.
Medieval	Mound E	Islamic coins, not yet identified Saint's Tomb
Historical	Mound AB, Harappa town Old Police Station Mound	Mosque, Harappa Town Mughal Fort and Serai British Police Station, etc.

(After Richard Meadow and J.M. Kenoyer)

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APPENDIX V

Continuity and Change in Culture

(Early Harappan and Mature Harappan)

		Kot Diji-Sothi Complex (Early Harappan)	*Indus-Sarasvati Civilization (Mature Harappan)*
ARCHITECTURE	FORTIFICATION	√	√
	FORTIFICATION WITH BASTIONS	?	√
	CITADEL	?	√
	PLANNED CITIES	?	√
	CEMETERY	?	√
	CIVIC ARCHITECTURE	?	√
RELI-GION	MOTHER GODDESS FIGURINES	?	√
	FIRE ALTARS	?	√
ART	STONE SCULPTURES	?	√
	BRONZE SCULPTURES	?	√
POTTERY MOTIFS	INTERSECTING CIRCLES	√	√
	FISH SCALE	√	√
	FISH	√	√
	PIPAL LEAF	√	√
TERRACOTTAS	CART FRAMES	√	√
	CART WHEEL	√	√
	CAKES	√	√
	BANGLES	√	√
	ANIMAL FIGURINES HORSE	?	√
	HUMAN FIGURINES	√	√
SEMI-PRECIOUS STONES	TURQUOISE	√	√
	LAPIS LAZULI	√	√
	CORNELIAN	√	√
	SHELL	√	√
	IVORY	√	√
	STONE DRILLS	√	√
COPPER BRONZE TECHNO-LOGY	LOST WAX PROCESS	?	√
	CRUCIBLES	√	√
	FLAT IMPLEMENTS	√	√
OTHER ITEMS	GRAFFITI MARKS	√	√
	WRITING	?	√
	INSCRIBED SEALS AND SEALING	?	√
	WEIGHT AND MEASURES	?	√
	TRADE WITH MESOPOTAMIA	?	√

(After Shashi Asthana)

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APPENDIX VI

Indus-Sarasvatī Civilization: Stages of Development

PERIOD	APPROXIMATE TIME BRACKET	REGION					
		PUNJAB	SINDH	RAJASTHAN	HARYANA	GUJARAT	MOUNTAIN REGION
LATE PERIOD	1900 BC TO 1500 BC	CEMETERY-H	JHUKAR	?	MITATHAL-IIB	DHOLAVIRA-IV KUNTASI-II SURKOTADA-IC	MEHARGARH-VIII
MATURE PERIOD	2600 BC TO 1900 BC	HARAPPA-III	MOHENJODARO UPPER LEVEL	KALIBANGAN-II	BANAWALI-II	DHOLAVIRA-IV KUNTASI-I SURKOTADA IA-IB	NAUSHARO-II
TRANSITION PERIOD	2800 BC TO 2600 BC	HARAPPA-II	MOHENJODARO INTERMEDIATE	KALIBANGAN OVERLAP	BANAWALI-IC	DHOLAVIRA-III SURKOTADA-IA LOWER LEVELS	NAUSHARO-II-IC
EARLY PERIOD	3500 BC TO 2800 BC	KOT DIJI	KOT DIJI	KOT DIJI KALIBANGAN-I	KOT DIJI BANAWALI IA-IB	DHOLAVIRA I-II	MEHARGARH V-VII
FORMATIVE PERIOD	4000+ BC TO 3500 BC	RAVI CULTURE PRE-KOT DIJI 4M DEPOSIT OF HANDMADE BLACK PAINTED RED WARE	AMRI CULTURE	SOTHI CULTURE	KUNAL CULTURE	PADRI CULTURE	MEHARGARH IV-V

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61. *martasah santah amrtavamanasuh* (I.110.4)
62. 'Wealth from the Rbhus is most glorious in renown, that which the Heroes, famed for vigour, have produced... Great store of wealth and mainly power hath he obtained from Vaja, Vibhvan, Rbhus have looked kindly on ... Fashion us, O Rbhus, power and splendid wealth... Bestowing on us here riches and offspring, here fashion fame for us befitting heroes. Vouchsafe us wealth of splendid sort, O Rbhus, that we may make us more renowned than others (IV.36.5, 6, 8, 9).
63. *ayam vam madhumattamah sutah rtavrdha*
tamasvina pibatam tiro-ahayam dhattam ratnani dasuse...
asvina madhumattatamam patam somamrtavrdha
athadya dasra vasu bibhrata dasvamsam upagacchatam

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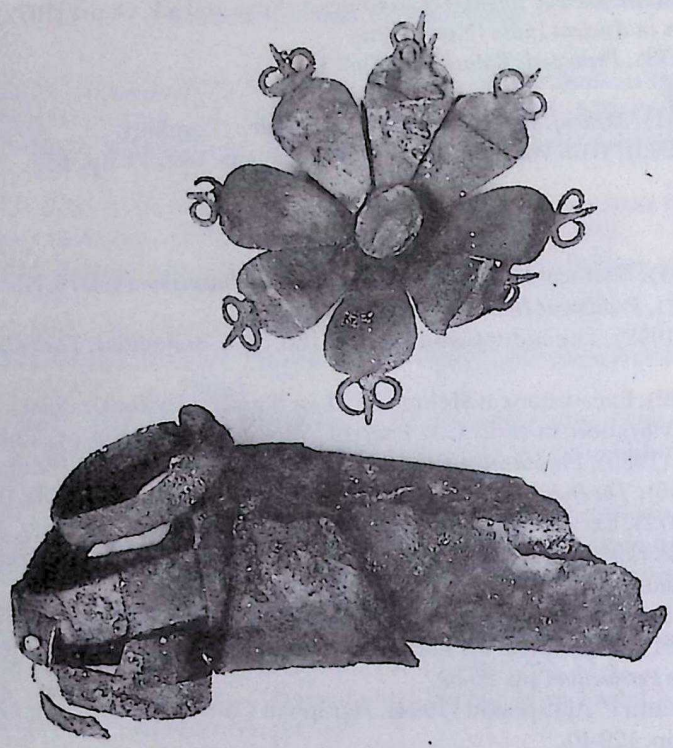

Plate 1: Kunal, Silver objects, including Tiara *(Mukut)*.

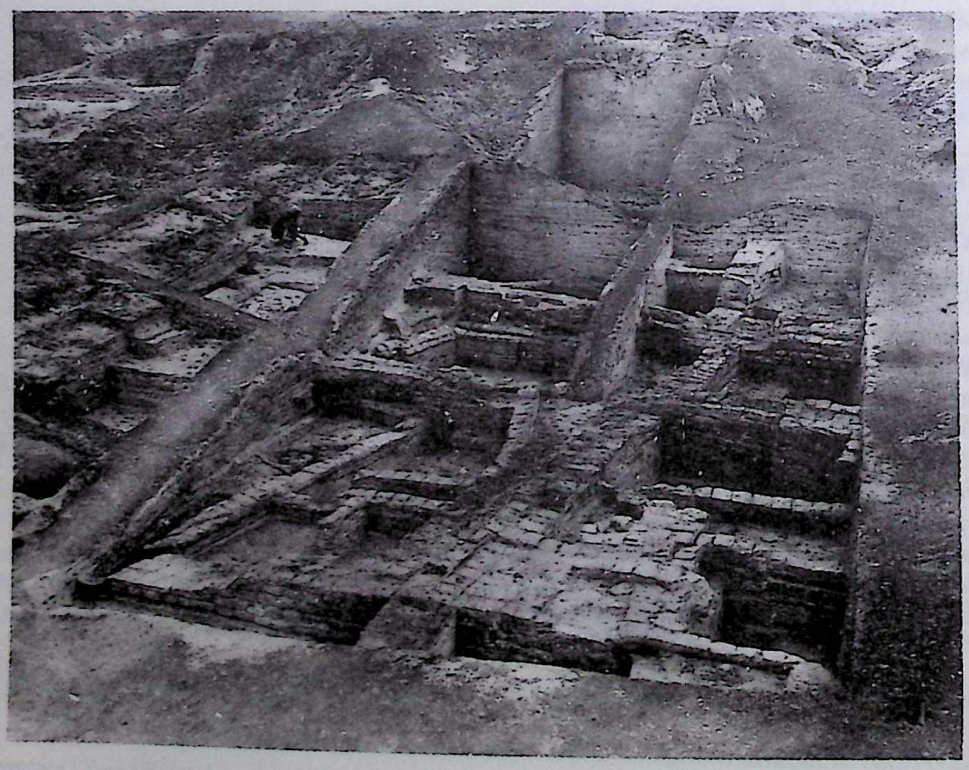

Plate 2: Houses of the Kalibangan-I, Kot Diji Culture.

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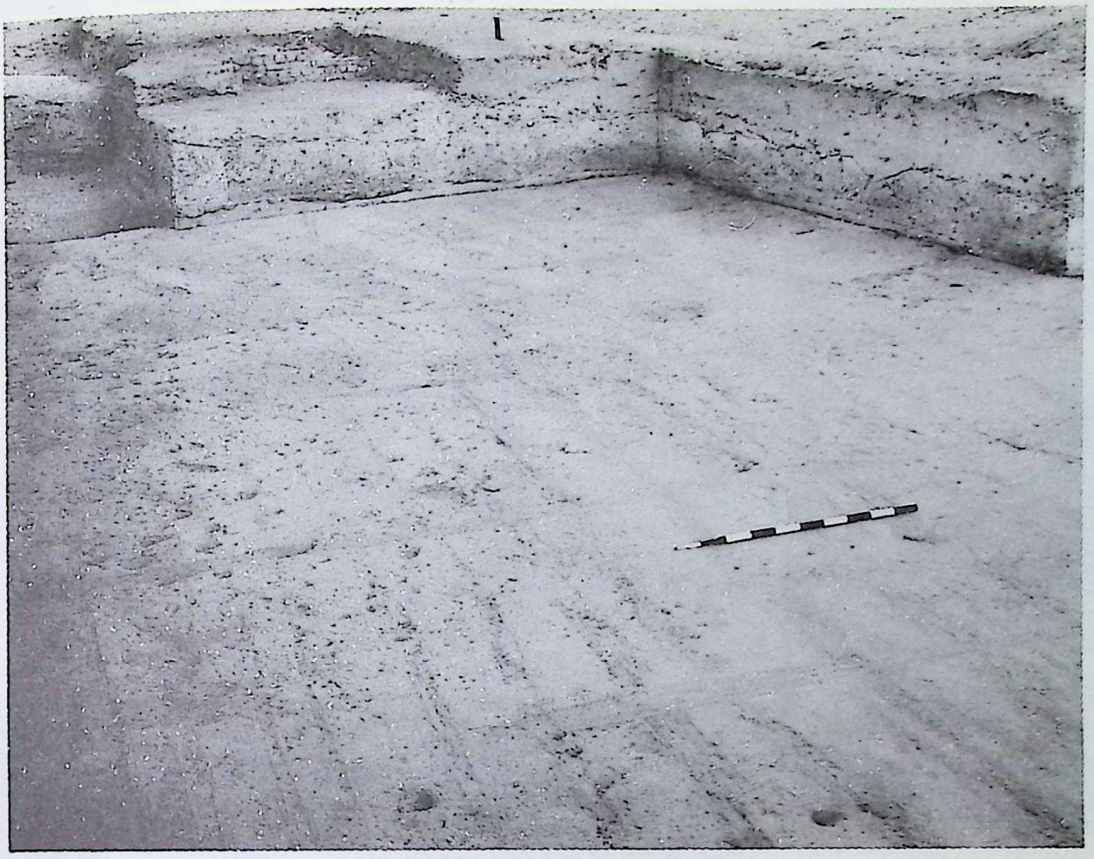

Plate 3: Kalibangan: Ploughed field of the Early Harappan times (Kot Diji).

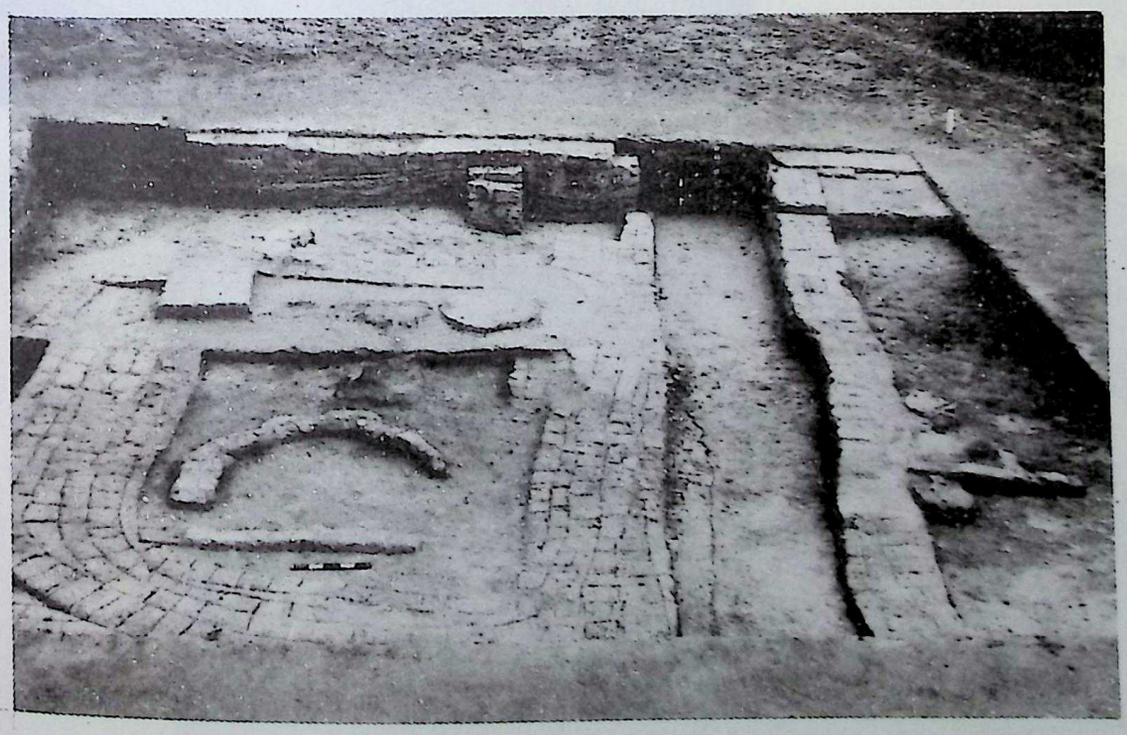

Plate 4: Banawali: Fire Altars in an apsidal brick temple.

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Plate 5: Banawali: Brick-lined well.

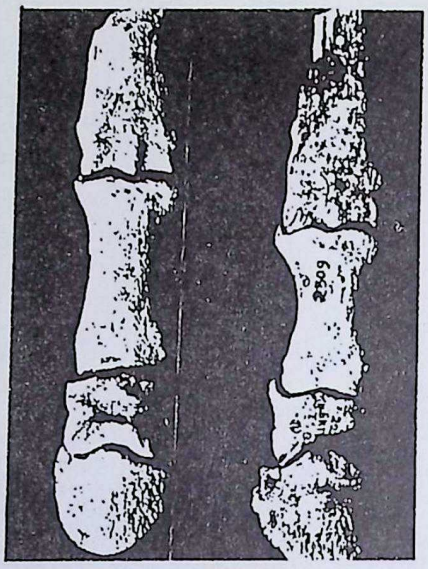

Plate 6: Surkotada: Leg bones of a domesticated horse

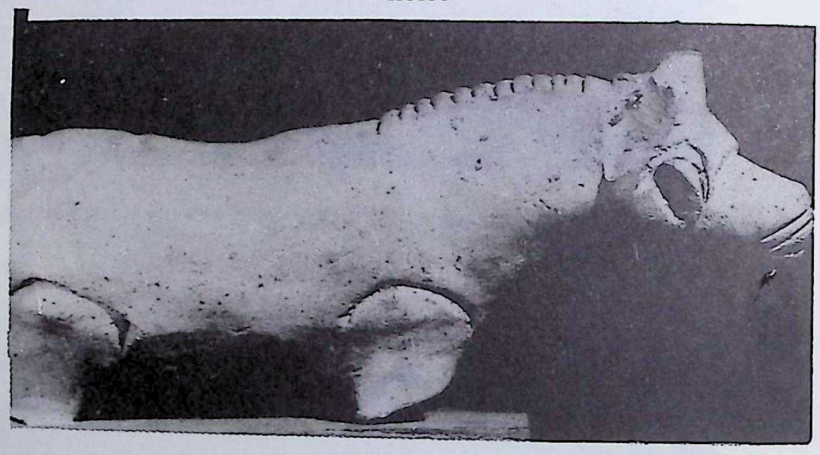

Plate 7: Lothal: Terracotta figurin : of a horse.

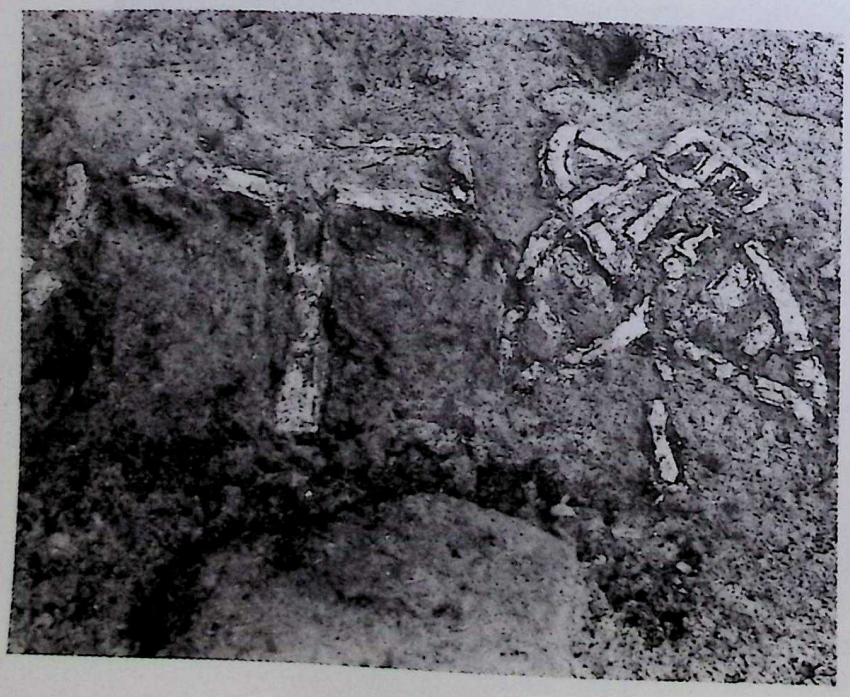

Plate 8: Mohenjodaro: Skeletons of the people caught in floods.

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Plate 9: Part of the Sign-Board Inscription

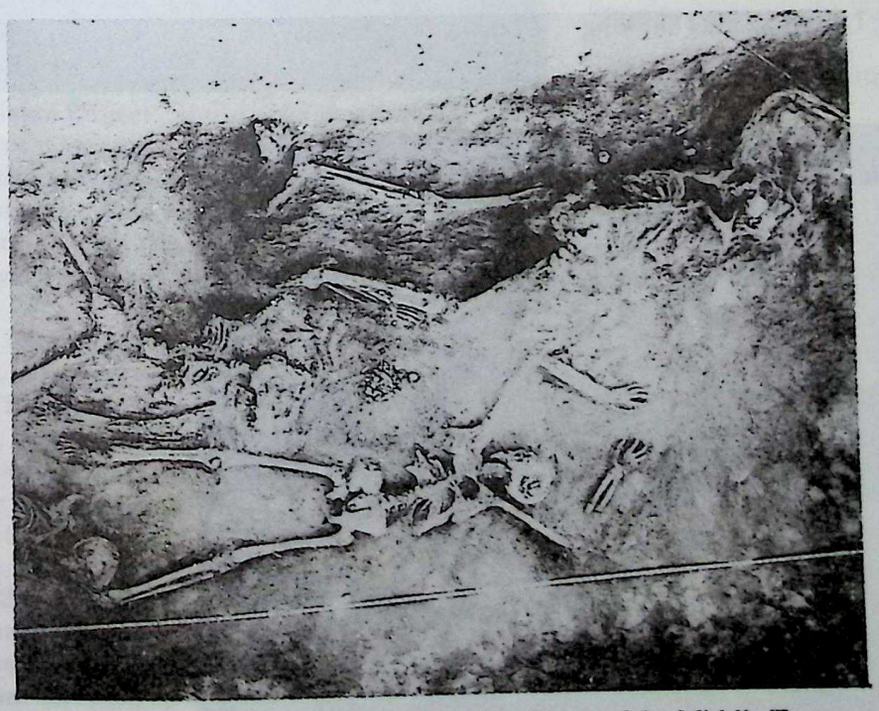

Plate 10: Dholavira—East-West Running Street of the Middle Town

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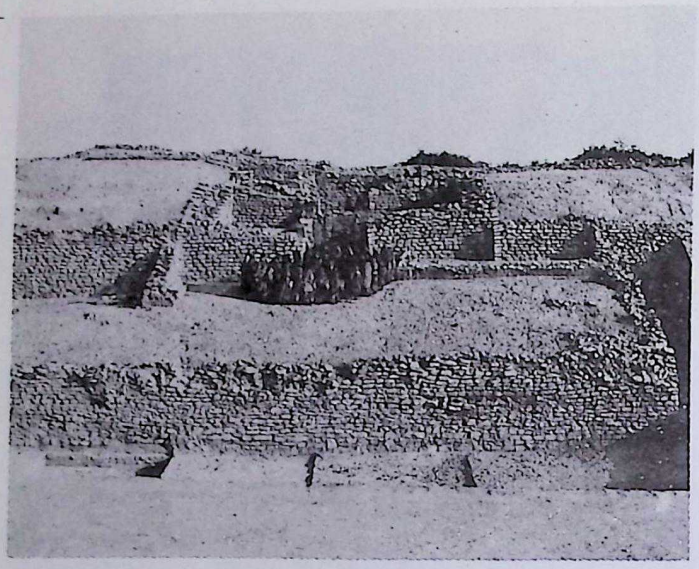

Plate 11: Dholavira: North Gate of Citadel

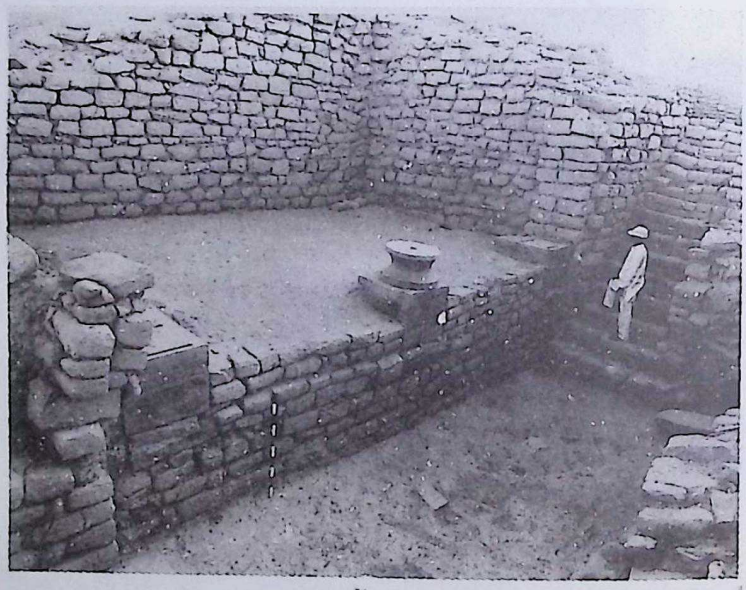

Plate 12: East Gate of Citadel Showing Architectural Members

Plate 13: Dholavira: Indus-Sarasvati Seals and Sealings. First Top Left is from the Early Levels of Indus-Sarasvati Period, i.e., Stage III

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CHAPTER XII

Religious and Burial Practices of Harappans: Indian Evidence

Jagat Pati Joshi

Excavations carried out in the last five decades in the Indian Union have thrown new light on the religious beliefs, burial practices and concept of life after death of the Harappans.

The earlier concept of the religion and burial practices of the Harappans was based on what was revealed by the remains – structures, motifs in pottery, seals, sealings, terracotta figurines and triangular cakes, stone objects and burials from the principal Harappan sites in the Indus Valley. It was that the religion consisted of the worship of a terracotta mother goddess, a horned Paśupati like deity having three faces, an earth goddess; *liṅga* and *yoni* worship; offering of sacrifices; tree worship (of the peepal tree); beliefs in half-human half-animal figures; regarding the bull as a sacred animal; snake worship; taking of ceremonial baths and practice of *yoga*; burying the dead in extended position in north-south orientation along with pots and pans offerings to be used by the deceased in the next life and also burying the dead in coffins with wooden or terracotta lids, as revealed at Harappa. This was the broad picture of the religious and burial practices of the Harappans in the Indus Valley as revealed by the excavations prior to 1947.

After the partition of India, due to the consistent explorations and excavations by Indian archaeologists, not only has the extent of the Harappa culture been extended far beyond the Indus Valley but many more regional variations within the Harappan civilization have been met within the Indian Union in the north from Manda in Jammu and Kashmir to Daimabad, Maharashtra, in the south, and from Desalpur in Kachchha, Gujarat, in the west to Hulas in district Saharanpur (UP), in the east, the principal excavated sites being at Desalpur, Dholavira, Surkotada, Lothal, Kalibangan, Banawali, Ropar and Alamgirpur. These regional variations in religion and burial practices, besides the patterns of settlement, make the entire picture very interesting.

The latest evidence of Harappan religion and burial practices as found in India could be classified into the following zones: (1) Ropar – akin to Harappa and Mohenjodaro so far as availability of terracotta cakes and representations of peepal leaf in pottery and the burial practices are concerned; (2) Kalibangan-Banawali, Lothal, Nageshwar and Vagad; (3) Surkotada and Dholavira.

(1) *Ropar*: Here a cemetery has been found with extended burials having pots and pans. The burials have been found with a north-south orientation. The dead have been buried along with ornaments, as evidenced by the find of copper bangles and beads from the skeletons. No

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other evidence of religious practice is available from Ropar except triangular terracotta cakes and representation of the peepal leaf on painted pottery.

(2) *Kalibangan-Banawali:* Kalibangan has yielded evidence of an animal sacrifice and fire altars. So far as animal sacrifice is concerned, its depiction on seals in the Indus Valley is available. At Kalibangan on one of the platforms atop KLB-1 mound, besides a well and a fire altar in an cistern like structure (1.25 × 1m), perhaps a *vedi*, made of kiln-burnt bricks has yielded a large number of bovine bones and antlers with cut marks [Pl. I], The sacrifice of bovines is corroborated by the *Ṛgveda* (*Ṛg.* X.16). The terracotta triangular cake (broken) shows engraved on one side a horned deity and on the other a person drawing an animal with the help of a rope (?) tied around its neck, possibly for a sacrifice to the 'horned deity with a central crest' resembling Śiva Paśupati on the seal. The sacrificial offering to the deity and sacrificial offerings to the sacrificial fire were two earlier and latter practices respectively.

In KLB-1 mound on the southern face of the rhomb, atop, were found seven altars [Pl. II], each measuring about 75 cm × 55 cm. Inside the pits of these fire altars, a stele of burnt earth was found in the centre along with ash, charcoal and terracotta triangular cakes, of course as offerings. The stele was 30-40 cm in height and 10-15 cm in diameter. These fire altars had behind them to the east a burnt brick wall running north-south. They were located in north-south alignment. Lal has pointed out that anybody who sits in front of the altar-like structures has to face east, which is a sacred direction for all sacrifices and rituals in the subsequent times. To the west of the worshipper was the lower half of a jar partly embedded in the ground and full of ash and charcoal. Perhaps it was kept ready for fire to be used for the rituals. The *yajña* fire has to be prepared separately. Some significance can be attributed to a well and a few bath pavements attached to the drains . This feature could be connected with some sort of ritualistic or ceremonial bath before the ritual on the altars. These platforms on the top in KLB-I are reached by a flight of steps on the southern entrance a number of post-holes might be for hoisting flags along the sides of the steps on ceremonial occasions. These steps led to five or six or even more ceremonial and ritualistic platforms on the top. A vivid description of the excavated remains has been given by Lal (1984) and he states:

> On northern side of the southern rhomb, almost alongside the exterior face of the fortification wall, there was a sufficiently wide mud brick on edge pavement which could have run up to the flight of steps which led to the entrance into the southern rhomb from this site. One is tempted to surmise that on specified occasions they marched on this paved pathway, a procession of priests, perhaps led by a high priest, and walking up along the flight of steps it entered the temple complex of the southern rhomb where the priests ascended one or separate platforms to perform or preside over the rituals. The laity by then had perhaps already gathered within the complex, entering it through the southern gate.

The northern rhomb had streets with houses on either side. It appears that the priest and elite used to live on the northern side and used to go to the altar on platforms to perform the rituals.

In the residential area of the city in KLB-2 mound, in the houses individual fire altars have been found having a burnt earth stele in the centre and ash, charcoal, triangular and circular cakes in it [Pl. III].

KLB-3 is a small mound lying to the east of KLB-2 at a distance of approximately 80m. From the surrounding area the mound slowly rises to a maximum height of 2.50 m. It covers an area of 50m (east-west) × 70m (north-south). The mound is considerably eroded. Excavations in this mound revealed that when the Harappans occupied the mound it was already on an elevated natural formation. Digging to a depth of 2 m revealed two layers over the natural soil.

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Here, in an enclosed area within three walls of one to two courses of mud bricks of size 30×15×7.5 cm in an outer area of 4.90 m 3.40 m and 3.90 m×3.45 m inner area, the complete outline of the structure could not be recovered [Pl. IV]. One big and five small fire altars have been found with a considerable ashy ground area measuring 2.90 × 2.40 m. The area has yielded triangular terracotta cakes and pottery. Fire altar no. 1 is round in shape, (dia. 50 cm) and has burnt reddish loose earth. Fire altar no. 2, round in shape (dia. 40 cm), has a broken terracotta stele, a triangular cake, ash and burnt earth. Fire altar no. 3, round in shape (dia. 30 cm), has ash and loose brownish material. Fire altar no. 4 is rectangular and looks like an oven, it has one 25 cm (0.65 × 0.53) stele containing triangular terracotta cakes, burnt earth and ash. Fire altar no. 5 is oval in shape, having two steles – smaller axis, 0.48 cm; bigger axis, 0.65 cm. Near fire altar no. 4 and 5, a large number of terracotta triangular cakes and broken cakes and pottery have been found. In the adjacent trenches a wall having two courses has been found running north-south. The wall is 12 m in length and 1.65 m in width. The distance between the fire altar complex and the wall is 4.65 m.

Amongst the antiquities found in the area, a fragment of a terracotta ram, a piece of copper, one chert blade, one terracotta triangular cake with a finger nail impression, a fragment of a terracotta cot, wheel and two complete bangles, one finial-shaped object and one miniature handmade bowl and a plethora of pottery. The area has yielded a large number of terracotta triangular cakes, round complete and broken ones have also been found.

The pottery from the area consisted of typical Harappan red ware and black painted on red ware. The shapes have been dishes, dishes-on-stand, beakers, pointed-bottom goblets, miniature jars and a beautifully painted miniature jar. Fifteen per cent of the pottery being pre-Harappan, indicates its occupation during the mid-levels of the KLB-2 sequence.

Bones recovered from the altars include those of the following animals: bovines, zabu, goat or sheep, deer.

It appears that fire worship was performed by the people of Kalibangan. It had one temple on a platforms in the citadel for the elite and another to the east of KLB-2 for the city dwellers. Allchin (1994) has rightly remarked, 'These three contexts suggest that the fire rituals formed a part of the religious life of the town at a civic, domestic and popular level. They are also suggestive of an Indo-Iranian, if not more specifically Indo-Aryan element in the culture of the period covered by these fire altars.' The city-dwellers also individually worshipped fire in houses where altars have been found. Lal (1994) has suggested that to explain the need for a second fire-altar complex 'the answer might be either in temporal stratification or even in social stratification'. This evidence leads us to envisage that the Harappans had a society of different classes of people, viz., the priests and elite of KLB-1, and the common residents of KLB-2, the agriculturists and tradesmen. At other Harappan sites the workmen were found living separately, e.g. in Harappa, Lothal, Mohenjodaro. This could perhaps throw light on the beginning of the broad four-fold division of the society later.

The situation of numerous fire altars to the east of habitation is significant as this cardinal direction is supposed to be auspicious for worship even today amongst the Hindus.

No terracotta mother goddess of the Indus style has been found at Kalibangan. The peepal leaf motif is available in painted pottery which must have been considered sacred. Numerous figures of small bulls are available, besides one showing the charging mood of the animal. It appears, as in other Harappan sites, that the bull was also worshipped here. Besides the triangular cakes of different dimensions, terracotta cakes of the round variety with a depression, the *muṣṭika* type with finger impression, and the circular type with a depression in the centre, and the oval-shaped one are also available. It appears that the cakes could have some religious significance, particularly the triangular and *muṣṭika* ones. One of the broken triangular cakes shows a horned deity on one side, and the figure of a goat led by a man on the other, which further confirms the identification of such cakes having possible religious

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application [Pl. V]. The *muṣṭika* type of cakes are still used in *śrāddha*, but such cakes are now replaced by *piṇḍas* made of rice, barley and flour. The *muṣṭika* type of cakes are not reported from the Indus Valley sites.

Another interesting point which emerged is the association of the triangular cake with the religious practice of offering it in the fire altar. Besides, the evidence of an engraved terracotta cake, most probably also shows that the horned deity is offered a goat carried by a man.

So far as the burials at Kalibangan are concerned, these are of three types. Type I (*i*) extended, north-south orientation; (*ii*) special burial to an old man in a large brick walls plastered grave, having 70 pots besides the skeleton. Type II: Rectangular, oval or oblong pot burials with bones; Type III: Pot burials without bones. According to A.K. Sharma, the extended burials were given to bodies of diseased persons or persons who died with deformity or accident, as the skeletons in the extended burials have revealed persons suffering from one or other disease. Even today, some diseased persons are not cremated but buried, e.g., those who have died of smallpox. The pot burials could be memorial burials. They might be practicing *Nadi Pravāha* and cremation of the bodies and later performing memorial burials of pots with bones or without the bones of the cremated person. In extended burials, bones of goats and bovines are also found. Sharma finds a corroboration of the evidence in respect of burial no. 29, a burial in a brick lined channel, in *Ṛg.* VII. 89, wherein we have the prayer, 'O Varuṇa, may I not go to the earth house'. Besides, there is a burial where there is evidence of performing *mukhāgni*, i.e. placing fire in the mouth before disposing the dead.

At Banawali, inside an apsidal mud brick temple remains of a highly burnt terracotta stump with ash has been found [Pl. VI]. This shows that the Harappans at Banawali had even erected an apsidal temple over the fire altar. Besides this, in some houses fire altars have been found containing ash and burnt stump of a stele, cylindrical or rectangular in the centre of a pit. This is an important evidence in the Sarasvatī Valley which is unparalleled in the Harappa civilization. At Banawali the peepal leaf motif is seen in painted pots. Triangular, round, spherical, and *muṣṭika* type of terracotta cakes are also available.

A few mother goddesses of Indus style are also found which appear to be intrusive cult objects brought by the Harappans or their descendants from the Indus Valley who visited or lived at Banawali. They might have been performing the worship of the typical Indus mother goddess in their houses. No burials were available at Banawali as a result of the ploughing activity of the green revolution.

At Banawali a sealing bearing a depiction of a 'unicorn bull and a long-horned goat, each of which figure independently, are standing in reverence before an oversized male figure, which has raised its left hand in a posture of protection'. According to Bisht (1987), 'this may indicate that the Harappans conceived of their superior gods in human form where certain animals and plants symbolized different faculties or energies of nature or divine power'.

The evidence of fire altars over a platform in KLB-1, the existence of a number of fire altars and nothing else in KLB-3 and worship of fire altars in an individual house in KLB-2 and a fire altar inside an apsidal temple at Banawali and also in the houses point to the fact that fire worship was the most dominant religious practice in the Sarasvatī Valley.

At Lothal also, particularly in the lower town, fire altars occur in houses. These are erected on dwarf mud-brick platforms having rectangular and circular mud enclosures containing ash and terracotta cakes and, sometimes, painted potsherds. In street 1, a public fire altar, rectangular in shape and 90 cm deep, and another in street 9, also rectangular, and 30 cm deep have been found. These are made of burnt bricks and contain ash, and ovoid and triangular cakes. A painted jar adjacent to the altar in street 9 is also encountered. This street altar has depressions, one rectangular and another semi-circular, in the wall of the altar for 'keeping ritualistic vessels'. 'There is also a post-hole in the north-east corner of the altar for

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fixing a wooden post. The most interesting find is that of a ladle with soot stains at the back.' (S.R. Rao 1973) This could have been used as a *śruva*. The painted pot was probably used for keeping water for the *yajña*. Rao has been singularly lucky in getting complete evidence of a fire altar of Vedic tradition along with some of its accessories at Lothal. These altars belong to phases II and III at Lothal which is very significant.

The religious evidence at Lothal consists of availability of seals, sealings, indications of peepal tree worship and snake worship, and a figure of a terracotta mother goddess of Indus styles, and evidence of extended single and double burials. The burials have yielded the bones of bovines and goat also. The double burials are not found anywhere in the Harappan context and seem to be a special contribution of Lothal to the religious and funerary beliefs and practices of the Harappans.

One group of anthropologists has identified male and female skeletons in each of the two double-burials [Pl. VII]. This could, according to S.R. Rao, indicate a *satī* of a later period when, on the death of the husband, the wife used to immolate herself.

Nageshwar: At this site in the Harappan context, a 165 cm diameter pit with a *pranāḷā* towards the south and a conical clay mound at the centre has been found. The depth of the pit is 65 cm, the length and width of the *pranāḷā* are 120 cm and 50 cm respectively. The basal diameter of the cone is 90 cm. The pit contained a large quantity of ash. That very high temperatures were produced in it is evidenced by its burnt walls. The excavator feels the structure was used to produce a tall flame, like a pillar of fire.

Vagad: This is a rural Harappan site locally known as Kelvo Timbo. It is located to the south-east at a distance of about 1.5 km within the vicinity of Vagad village on the right bank of Bhalar river in Dhanduka Taluk of Ahmedabad District of Gujarat. This single-culture site with five layers is divided into two sub-periods. It has yielded evidence of four *yajña-vedikās* besides terracotta and stone weights; jars buried under the floors of the houses; pulley-shaped ear ornaments; partially ground and broken celt and graffiti on pots.

The four circular clay-lined fire pits on a slightly raised platform are significant. The platform is on the floor level of period IA. Mehta and Sonewane record three bigger ones with sagging base which were dug in the north, south and western portions of the trench. Their diameters are 1 m, 1.45 m, and 1.30 m, respectively. They were arranged in a triangular form at an approximate distance of about 90 cm between the two. A fourth fire pit, cylindrical in shape, having a diameter of 40 cm, is placed a little inside, between the southern and western pits. All of them were internally neatly plastered with cow-dung paste mixed with fine-clay. These pits contained ash, possibly of cow-dung cakes. In the absence of bone or any kind of industrial material, these fire pits appear to have been used for some kind of ritualistic purpose.

> Offering in fire was a well known practice in the *yajñas*. From *Vedic* times the practice of the performance of *Iṣṭis* or *yajñas* is fairly common and widespread. The Vedic texts mention these fires, namely *Gaśpatya, Ahavāmīya* and *Dakṣiṇātya*. Along with these there is also a provision for one more circular pit (smaller one generally at the centre) known as *litkar* in the traditional *Vedic yajña śālās*. The present evidence from Vagad, therefore certainly shows some close resemblance with Vedic practice of fire worship. It is interesting to note that the northern and western circular fire pits at Vagad have been provided with a square raised mud platforms probably for those officiating at the rituals. (Sonawane and Mehta, *Vagad*)

The description of the *yajñakuṇḍas* given by the excavators is very important. These are pure *yajñakuṇḍas* without any cylindrical stump as at Kalibangan. Thus they appear to be slightly different. Daimabad also yielded evidence of an extended burial. In the late Harappan context the oval structures from Bhagwanpura may have some religious significance and

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similarly the legged terracotta figures found from Bhagwanpura and other sites of late Harappan period.

Surkotada-Dholavira: So far as Surkotada is concerned, it has yielded some terracotta *pārthiva-liṅga*-type clay objects, peepal leaf motifs in pottery and memorial burial with or without bones in a pot. The pit of the burials has either a slab on the top or a cairn as in a megalith (J.P. Joshi, *Excavations at Surkotada*, ASI, 1990, p. 371).

At Dholavira male and female buffish standing terracotta figurines have been found which are altogether different from the typical Harappan figures besides a figure of a mother goddess of Indus style. The peepal leaf motif is seen on the painted pottery. The burials have stone orthostates in the centre of a rectangular pit for keeping bones.

The Emergent picture: The above evidence from the excavations suggests that, within the matrix of the Harappan civilization, broadly it could be said that the Harappans of Punjab and Sindh were basically *Śiva, śakti*, and *Liṅga* and *yoni* worshippers who offered animal sacrifices, buried their dead in an extended fashion and practiced '*Yoga*' as revealed by the *Śiva-Paśupati* seal and the other two seals of a horned deity and numerous terracotta figurines showing various *yogic āsanas* or postures (Appendix A).

The people of the Sarasvatī valley at Banawali and Kalibangan were fire worshipers who practiced such worship in a big way i.e. (1) inside an apsidal temple as at Banawali; (2) on a platform in the citadel mound (KLB-1) at Kalibangan which was an area reserved exclusively for the elite who lived in the western half of the mound (3) individual fire worship in the houses in the city mound (KLB-2) ; (4) at a cluster of fire altars to the east of the city mound for community worship (KLB-3). Fire worship is also indicated at Lothal and Nageshwar.

So far as the burials at Kalibangan are concerned, these are, (1) extended; (2) pot burials with bones; (3) pot burials without bones, which shows that the Harappans at Kalibangan also adopted some other mode of disposal of the dead, viz. *Nadi Pravāha* in a river and cremation, while at Lothal extended and double burials (*Satī* type of later periods) are also available in the Harappan cemetery.

The 'megalithic type' of burials in a part of the cemetery at Surkotada (The other part of the cemetery remains unexcavated), one yielding a small piece of human bone and other without any such interment (Fig. 1) and at Dholavira a grave lined with vertical slabs and covered by horizontal slabs having pots and pans without any skeletal remains. In one of such graves is contained a clay coffin of human size gray coloured, smeared with red ochre without any human bones besides another type of grave with a cairn circle with a small chamber in the centre without any bones. Those indicate an altogether different way of burial not found in any other Harappan Site.

The variation in burial practices is also indicative of a different group. We are inclined to agree with Rao who rightly feels that 'most of the Aryans seem to have changed from inhumation burial to cremation in the Ṛgvedic period as is clear from verse *Ṛg.* VII.39. As Varuṇa is associated with burial (house of clay), the reference is to a funerary custom of the Asuras.'

Now in the light of the above it appears that within the Harappa civilization there appear to be three main religious sects: (1) the Śiva-Śakti worshippers of Punjab and Sindh; (2) the fire worshippers of Kalibangan-Dholavira, Lothal, Nageshwar and Vagad; and (3) the Surkotada-Dholavira people, who buried their dead in an altogether different way. Some folks at Surkotada worshipped clay *liṅgas*. This may be an intrusive element in the population and Dholavira people worshipped buffish male and female terracotta deities. The availability of a few mother goddess figures at Banawali (five), Lothal (one) and Dholavira (one), suggests contact or a few people practicing the original mother goddess cult at these sites.

The literary evidence from the *Ṛgveda*, viz. the Battle of the Ten Kings at Hariyūpīyā (probably Harappa) where the Ṛgvedins routed the Ten Kings led by Viśvāmitra, tempts one

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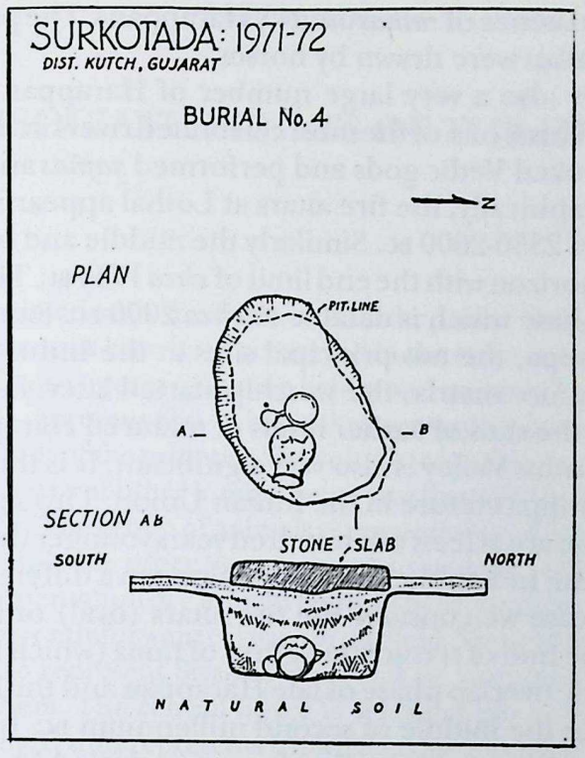

Fig. 1: Surkotada Burial No. 4.

to wonder whether these Ṛgvedins or their descendants were the fire worshippers of the Sarasvatī valley. S.B. Roy says that there were two battles on the banks of the Ravi: 'The first of these battles is of Harappa (Hariyūpīyā) in which Harappa was conquered by Cayamana, the father of king Sudasa and Varasikha, king of Hariyūpīyā was killed and finally the granary of Harappa (*yavyavatī*) was looted and 200 armoured guards were killed.' In the second immediate Battle of Ten Kings which was fought on Paruṣṇī river (Ravi) very near to Harappa the *asuras* were defeated by the *devas*. It was a total victory of the *devas* (Ṛgvedins) and a total rout of the *Asura-Dānava Dānu Matira* (*ṚV.* IV.307) or Harappans in the region of Harappa. In this battle, the *Pañcajanas*, the Harappans, were defeated in their attempt to regain Hariyūpīyā. Sudasa finally established the hegemony of the Ṛgvedins. On an astronomical basis, Roy has given a date of 1735 BC ± 75 BC to this war.

The literary reference appears to be important form the point of view of analysis of data in the context of archaeological finds. One would like to agree with Rao (1973), and postulate 'more than one ethnic group including the *pre-Vedic* Aryans were responsible for evolving the sophisticated urban life and political system of the Indus civilization'. These pre-Vedic Aryans could be identified with the kings who fought under Viśvāmitra and represented the *Asuras* of Punjab and Sindh of the Harappan civilization and *Devas* were the fire-worshippers of Kalibangan, Banawali, Lothal, Nageshwar and Vagad. While there was homogeneity amongst both, religious and burial practices gave them an identity of their own. Apparently, the picture shows a regional variation but one cannot ignore the above described position, which is important.

The availability of evidence of the horse from Kalibangan, Surkotada and the terracotta figure of a half-horse half-human and a figure of terracotta horse from Lothal, and absence of the horse from the sites of the Indus Valley, except at Mohenjodaro where it occurs in the upper levels, is an interesting pointer giving weight to the hypothesis. The *ekkā* or *ratha* type of terracotta toy cart from Lothal and the spoked painted terracotta toy cart frames from some

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of the sites attest to the existence of *rathas* used by Harappans. The painting on one sherd from Lothal may attest that *rathas* were drawn by horses.

Finally, numerically also a very large number of Harappan sites are available in the Sarasvatī-Hakra system. This is one of the most celebrated rivers in the *Ṛgveda*, on whose banks the *mantra draṣṭā ṛṣis* invoked Vedic gods and performed *yajñas* and composed Vedic verses.

Chronology: Stratigraphically, the fire altars at Lothal appear in the II and III structural phase which is datable to 2350-2000 BC. Similarly the middle and upper levels of Kalibangan are datable to the same horizon with the end limit of *circa* 1750 BC. The fire temples at Banawali belongs to the middle phase which is datable to *circa* 2000 BC. Fire altars are not available at Mohenjodaro and Harappa, the two principal sites in the Indus valley. This suggests that, within the Harappan culture matrix, fire worship started later, i.e. after a gap of about two hundred years or so. In the sites of earlier levels of matured Harappan culture in India and its total absence in the Indus Valley is also very significant. It is thus available in middle and late levels of mature Harappa culture in the Indian Union. This signifies that this belongs to a group of Harappans who are at least two hundred years younger than the original Harappans of the Indus Valley and the Indian sites also may belong to a different group having common origin. Besides this, in case we consider the fire altars (oval) of Bhagwanpura, the legged terracotta figures and the find of terracotta figures of rams (which is associated with *Agni*, the fire god) belonging to the overlap phase of late Harappan and the PGW phase shows that fire worship continued up to the middle of second millennium BC. Incidentally, Bhagwanpura excavations have given evidence of two floods, one in period IA and another in period IB (both the period belong to Bronze Age). The *Śatapatha Brāhmaṇa* mentions Kachchha. Tell El Amarna which has yielded tablets mentioning the names of Vedic gods and has also yielded glass in various stages of manufacture dating back to 1500 BC to 900 BC. This is a stage (Bhagwanpur period IB) when the orientation of the burials remained north-south but they started burying their dead within the habitation area and without grave goods. We would like to ascribe this period of overlapped sub-period to the later Aryans. Incidentally, M.D. Khare has reported from Dangwada *Yajña kuṇḍas* in houses and a *Devagṛha* with three white bricks and an apsidal temple in the Chalcolithic context. Again at Navadatoli a *Yajña kuṇḍa* of 2.03 × 1.96 m area, 10m deep, was found containing charred wooden sticks placed crosswise along with two high-necked jars placed nearby. The tradition of *yajñas* continues during Chalcolithic times. It was a hangover from the earlier religious legacy and was discontinued for some time during the period of the iron-using painted Grey ware people. In the above context a three-fold division could be envisaged, i.e., Harappans of the Indus Valley, who could be perhaps early Aryans: The Ṛgvedins of the Sarasvatī Valley and Lothal, Panis, the great traders of Patal, i.e. Surkotada-Dholavira of the Kachchha region; and the later Aryans of Haryana and Punjab represented by Dadheri and Bhagwanpura respectively.

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APPENDIX

ŚAIVA AND ASSOCIATED CULTS OF THE INDUS VALLEY

The articles of worship associated with the Śaiva cult of the Indus Valley include seals, rings and cylinders. A number of steatite seals have been recovered in the ruins of Mohenjodaro and Harappa. They are invariably embossed with figures of human beings and animals. Those which come under the first category are supposed to represent Śiva in his anthropomorphic form. Three such seals deserve special consideration in the study of the primitive Śiva cult. On one of them, there is a figure of a human being in the centre, surrounded by another human being and five animals viz., a buffalo, a rhinoceros, an elephant, a tiger and a deer. The group of animals represented on the left hand side of the god are the buffalo and rhinoceros, while the other two groups of animals viz., the elephant and tiger figure on his right, with a crude representation of a human being in between them. The deer however figures under the seat of the god, apparently for want of space in the field. The god represented in the aforesaid seal is supposed by scholars to represent Śiva-Paśupati, and we have no hesitation in accepting the identification proposed by them. The central figure in question has three faces and wears a crown decorated with a pain of horns. It thus represents triple faced Śiva, the like of which have been found in Elephanta caves and also at other places. Triple faced Śiva is also in evidence in a gold coin of Huvishka. The belief hitherto maintained is that images bearing three faces represent Brahma, Viṣṇu and Śiva, but this identification is not beyond cavil. The *Trimurti* represented in the seal can as well be Aghora, Vāmadeva and Tatpuruṣa, the three different aspects of Śiva. The figure having three faces in the Elephanta cave is now believed by some scholars to represent the very same deity, and we have no hesitation to admit that the same is the case with the Trimurti figure to be found in the aforesaid gold coin of Huvishka. Under the circumstances, it is difficult to connect the triple-faced Śiva figuring on the seal discovered at Mohenjodaro with Śiva-Paśupati on any iconographic ground; but in the earliest stage of Śaivism the different aspects of Śiva were probably not seriously taken into consideration, it appears that they were still in the nebulous stage or at least had not reached their formative period. Whatever the case may be, in a single protohistoric seal we find a unique representation of the three different aspects of Śiva. There is, however, no doubt that the maker of the seal wanted to depict god Śiva as the 'Lord of animals'; and hence in the limited space available he had succeeded in depicting four big-sized animals besides the figures of a deer and that of a human being as stated above. The god has been further represented as sitting on a low seat in a typical attitude of yoga with legs bent double beneath him, heel to heel and toes turned downwards. This particular meditative posture actually corresponds to the yogic sitting posture known as *kūrmāsana*. Sir John Marshall (1931) has summarized the details of the god as follows :

> The god who is three-faced, is seated on a low Indian throne in a typical attitude of yoga, with legs bent double beneath him, heel to heel and toes turned downwards. His arms are outstretched, his hands, with thumbs to front, resting on his knees. From wrist to shoulder the arms are covered with bangles, eight smaller and three larger; over his breast is a triangular pectoral or perhaps a series of necklaces or torques, like those on the later class of goddess figurines from Baluchistan; and round his waist a double band. The lower limbs are bare and the phallus (*urddhamedhra*) seemingly exposed (but it is possible that what appears to be the phallus is in reality the end of the waist band). Crowning his head is a pair of horns meeting in a tall head dress. To either side of the god are four animals, an elephant and a tiger on proper right, a rhinoceros and buffalo on his left. Beneath the throne are two deer standing with heads regardant and horns turned to the centre. At the top of the seal is an inscription of seven letters, the last of which for lack of room at the right hand top corner has been placed between the elephant and the tiger.

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Dr. Banerjea has suggested that just below the trunk of the elephant on the top left corner and above the tiger there is a crude outline of a human figure. Marshall is undoubtedly right in attributing divine character to the figure represented on the seal, not only by the three faces but also by the yogic-asanas, and its association with several animals. He concludes that the figure is a prototype of Śiva Paśupati. While we agree with Marshall in respect of the description as given by him, we are not so very certain as to whether the so-called buffalo device is not a crude representation of the sacred bull of Śiva, which is known to us by the name of Nandi. In any case we have no cogent reason to believe that the figure in question is other than that of Śiva-Paśupati in his anthropomorphic form.

There is one interesting feature in the yogic posture of Śiva which cannot be passed unnoticed. The maker of the seal has represented the god as *urddhva-liṅga* (ithyphallus). This particular yogic characteristic is significant. Although it is not possible for us to say anything definitely, yet it seems that the association of Śaivism with phallic worship had its genesis in this kind of representation of the god Śiva. The popular belief of the time seems to have been that, if the god is depicted in human form, his generative power should be represented by the *urddhva-liṅga*; otherwise the phallic symbol would also serve the purpose of representing him in regular worship. This is one theory regarding the origin of phallic worship, though there are others .

As regards the other two seals bearing a human figure, both of which are smaller in size than the one described above, archaeologists are unanimous that they also represent Śiva in a slightly different form. The main difference in respect of the depiction of the figure of Śiva on the two smaller seals and that on the bigger one is that, whereas in the latter we find a three faced deity, in the former he has been shown as having one face only. At the very outset, in respect of the two smaller seals, it must be mentioned here that we miss in them the figures of animals surrounding the deity, as are to be found in the bigger one. A closer examination of the two smaller seals brings out the following points of similarity and dissimilarity, when we compare them in respect of the representation of the deity.

In respect of the figure of the deity, the following are the common features between the two seals: (1) he is represented as wearing a head-dress and that too practically of the same style; (2) number of bangles on either hand are the only ornaments decorating his person; (3) He is depicted as wearing a *kaupina* unlike in the bigger seal where he has been represented as naked; He sits in a particular form of *yogic āsana* (*Kūrmāsana)* on low flat stool.

The following discrepancies are to be noticed in respect of the figure of the deity between the two seals: (1) in one seal he is represented as having long matted hair (*jaṭā),* which however is not to be found in the other; (2) in another seal, on his head there is a representation of a small plant with three branches, whatever it may signify, while in the other, the same has been depicted as a number of sprouts.

Coming to the question, whether Śiva is the only deity depicted in the aforesaid bigger and the smaller seals, it may be noted here that in all of these the deity in question has been represented as wearing a crown decorated with a pair of horns and as sitting in the well-known meditative posture of *kūrmāsana.* Whereas the god depicted in the bigger seal may be taken to represent Śiva-Paśupati with three faces, in his anthropomorphic form, which is undoubtedly a new device, and is not to be met with in later Indian art, in the smaller seals he has been depicted only as Śiva, to which conclusion we arrive, by taking into consideration the aforesaid common characteristics.

The horn design or sharp buffalo-horned designs have been found painted in pottery from pre-Harappan and Harappan levels. It is available from Burzhom, Gumla, Rehman Dheri, Sarai Khola, Levan-dheri, Kalibangan and Kot-Diji. The standing horned figure from Kalibangan is engraved in a terracotta cake of which the lower portion is broken. The horned figure from Padri is also standing and is wearing skirt of grass. It is a complete painted anthropomorphic figure. The Levan example shows peepal leaves emanating from the space between the horns. Allchin observes that the horned figure of Levan 'anticipates the horned figure deity of the mature Indus period seals beyond doubt'. According to Parapola 'the evidence shows that the proto-Śiva has long local history'. However V.S. Pathak has clearly shown that 'the identification of the horned deity in pots, bowls and jars with a similar figure on the Mohenjodaro seal is neither desirable nor necessary. The horned standing figure found at Padri has been rightly identified by Pathak with Soma, and the pot to be ritualistic. He observes, 'Amongst the horned deities of the *Ṛgveda,* Soma, the personified form of the sacred plant is quite

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prominent'. The adjectives Tiguṇa Śṛṅga, having sharp horns, and Mahisa are applied to Soma. Soma is also king par excellence. The buffalo horn and grass skirt symbolize the personified Soma creeper and according to Pathak, it may be a jar for storing *somarasa* and could be *soma dhana kalaśa.*

Attention has been drawn by Mahadevan (1993) to Indra-Soma myths and 'the sacred filter standard is depicted on seals and tablets from the lowest levels of Harappa... it is more likely that some was one of the elements taken from the Harappan sub-stratum and assimilated by the early Indo-Iranian Society'. This could be vice-versa also as evidence of horse and chariot is now available.

If diversities are to be noted in respect of the representation of Śiva between the bigger seal, on the one hand, and the two smaller seals on the other, they seem to be due entirely to different conceptions of the deity, as we can easily imagine.

Incidentally, a question that occurs to us is whether the system of yoga is a legacy of the Harappans of the Indus valley. Marshall said that 'like Śaivism itself yoga had its origin among the pre-Aryan population'. In the entire *Ṛgveda* which is considered to be the earliest literature of the Aryans, there are references to *tapas* (penance) but not to yoga (meditation). It is more than evident from the text that the gods and goddesses mentioned in it are to be invoked and worshipped, but there is not the slightest indication that its compilers have even thought of yoga as another means of achieving the ultimate end of a man's life. It is true that the hymns embody conceptions of certain deities, but they are meant for daily repetition and not for meditation. The term *tapas* which occurs in the *Ṛgveda* suggests the practice of penance or mortification, that is to say, the control of the body but not sojourn through successive stages on planes of meditation for the realization of the Supreme or the Absolute. Undoubtedly *tapas* can control the body but not the mind, which has to be regulated and purified by an entirely different process. Since in the seals from the Indus Valley we have the earlier evidence of a yogic posture, and since yoga as a system of self-realization is foreign to the earlier Vedic texts, are we to conclude that the Aryans of the Sarasvatī Valley learnt about meditation and its technique from their neighbours, the Indus Valley people, who had already perfected that science for directing the mind towards the Absolute. If that is so, the adoption of yoga as a system for the realization of the Supreme Being by the late Aryans was consequential to the adoption of the Śaiva cult by them, the two probably being inseparable. That greatest of the yogis, Śiva, had to be realized through yoga was probably the message of the Indus Valley to their contemporaries when they later on met in the Indus Valley region and when they came intimately to know each other, banishing feelings of hatred and hostility, mutually exchanged their concepts of God, Soul and Heaven. It is an undeniable fact that the very religious system which the Harappans of Sarasvatī Valley despised as the cult of *Śiśnadevas* or phallic-worshippers was ultimately welcomed and embraced by them.

It is said that the Aryans stigmatized the peoples of the Indus Valley as *Śiśnadevas.* In two Ṛgvedic hymns that term has been found to occur apparently with reference to the primitive phallic worshippers of the Indus Valley. Indra, the guardian deity of the Aryans, has been invoked in one of the hymns to give them protection against the *Śiśnadevas,* when they were performing sacrifice; and in another hymn, the same god has been mentioned as the destroyer of the city of the *Śiśnadevas.* The epithet *Purundara* as applied to Indra in the *Ṛgveda* has its origin in this context; and we have been led to the supposition that the Harappans of the Sarasvatī Valley had already devastated a few settlements of the *Siśnadevas* under the mighty protection of their deity, as they believed. The exact significance of the term *śiśnadevaḥ* was not understood even seven decades ago; but it is now apparent that the articles of worship associated with the cult of Śiva which have been discovered in the Indus Valley are mostly of the nature of cylinders and rings, the former representing *liṅga* and the latter *yoni.* The cylinders are of different sizes. Likewise, the *yoni*-rings are also of different sizes or, more precisely, of different diameters. It is not that a number of cylinders or number of rings have been found in mass at a particular place, actually a cylinder and a ring have been found together in many places during excavations. This fact suggests that cylinder and ring are associated for some purpose and obstensibly, that could only be phallic worship.

We are not certain whether the cylinder and the rings were taken by the aforesaid Indus peoples as emblems or suitable signs of *puruṣa* and *prakṛti*, the two aspects of Nature, although such an inference is possible. The concept of *puruṣa* and *prakṛti* is also to be found in later Vedic literature, and if the same

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was entertained by the peoples of the Indus Valley there cannot be anything astounding about it. The two emblems may therefore be taken to suggest that, like the Aryans, the people inhabiting the Indus Valley also worshipped Nature, but in an entirely different way. The method of worship followed by the latter was however symbolical or realistic and not unrealistic like that of the former. But *liṅga* and *yoni* have somehow came to be associated with the worship of Śiva, as performed by the Aryans in the post-Vedic period. Now the question is whether the Śiva cult and the Nature worship of the Indus peoples, which were two different form of religion, came to be mixed up by the Aryans when they adopted Śaivism. Nothing can be said definitely on this point but the doubt remains whether actually, in the religion of the peoples in question, rings and cylinders were associated with the kind of Śaivism which they professed. The term *Śiśnadeva* does not suggest that the Indus valley people were worshipping Śiva and his deified female energy by means of *liṅga* and *yoni* as their respective symbols.

It is quite possible that those emblems were used by them for worshipping *Puruṣa* and *Prakṛti*, the two aspects of nature as stated above. Certain seals have been discovered in Mohenjodaro which clearly testify to the fact that the peoples of the Indus Valley worshipped *Prakṛti* by conceiving her as the Goddess of Fertility, who has been identified by some archaeologists as the Mother Goddess. Due to paucity of material we do not claim any finality in the solution of this problem and the doubt remains whether we are justified in considering rings and cylinders as articles of worship of a particular form of Śaiva cult or whatever it may be, as practised by the peoples of the Indus Valley. Whether the phallic worship amongst those peoples was associated with the kind of Śaiva cult practised by them must remain a matter of conjecture for the present.

In the Śaivism of the Aryans the bull plays a prominent part. Śiva himself is styled as *Nandīśvara* because he rides on a bull named Nandi. At the entrance of all Śiva temples the image of the bull Nandi is a regular feature. On some coins the bull also figures along with the same god. Now the question is: Did the association of the bull, Nandi, with Śiva have its origin in primitive Śaivism, as practised by the peoples of the Indus Valley, or not. If we admit that the Aryans had derived that religion from those peoples, then the presumption would be that the former had also accepted all its special features, believing them to be its fundamentals or essentials. That the bull played a prominent part in the cult of the Indus peoples has been admitted on all hands. A large number of seals have been found bearing the figure of a bull; and it is an undeniable fact that such seals are far greater in number than those bearing the figures of other animals. In the seal where Śiva Paśupati has been depicted amongst the large animals, Mackay recognized a buffalo. After carefully examining the seal, we have come to the conclusion that the so-called buffalo is nothing but a bull crudely represented with long and curved horns. If long and curved horns had led Mackay to identify the animal in question with 'buffalo', it may be mentioned here that there is not a single seal bearing the figure of a bull in which that animal has not been depicted in the very same manner. Want of space and crude methods of representation are responsible, in our opinion, for the depiction of a bull like a buffalo. This fact, coupled with the discovery of a large number of seals bearing the figure of a bull, have led to the conclusion that that animal was held in veneration and possibly was associated with the kind of Śiva cult which they professed. If the bull was associated with the peoples of the Indus Valley, and if their religion had been embraced by the Indo-Aryans at a later date, it is only natural that they would also learn to associate the bull with the god, who had been received in the latter's pantheon. It is, possible, however, that the name Nandi, as applied to the bull of Śiva, is of Aryan and thus of later origin, since it is to be met with in later and not in earlier texts.

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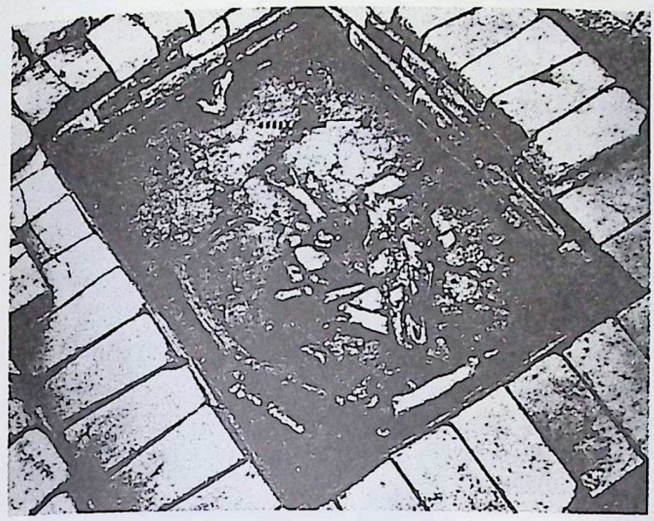

Plate 1: Kalibangan: A cistern like structure (Vedi?) with animal bones having cut marks.

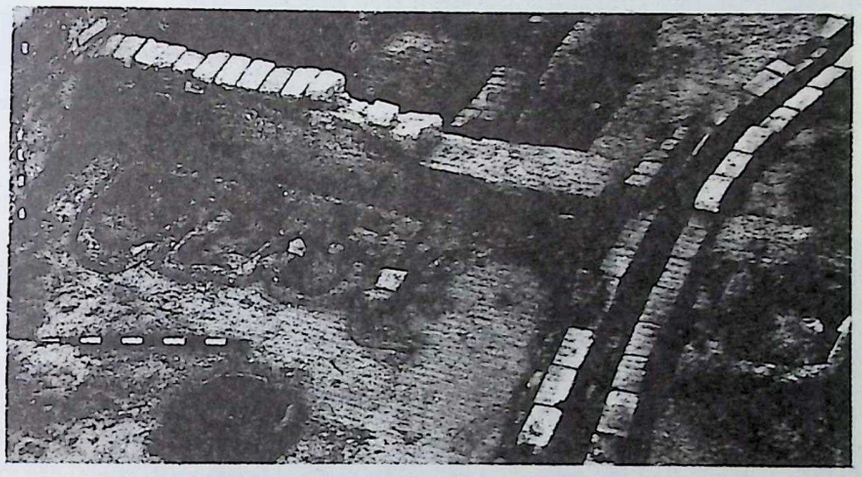

Plate 2: Fire altars with stele in KLB-1 Mound.

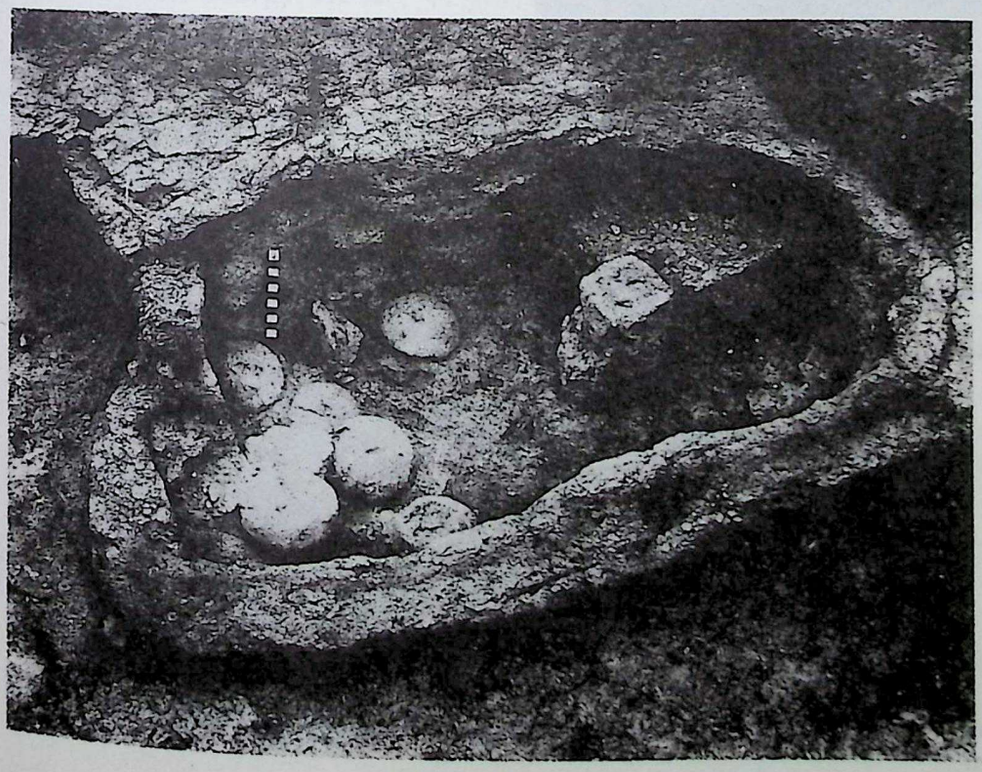

Plate 3: Kalibangan: Fire altar having a burnt stele in the centre and ash from a residential house.

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Plate 4: Kalibangan: Fire altars in KLB-3 Mound

Plate 5: Kalibangan: Terracotta triangular cake (fragmentary); Obverse (upper): engraved horned diety; Reverse (lower): engraved figure of a goat led by a man.

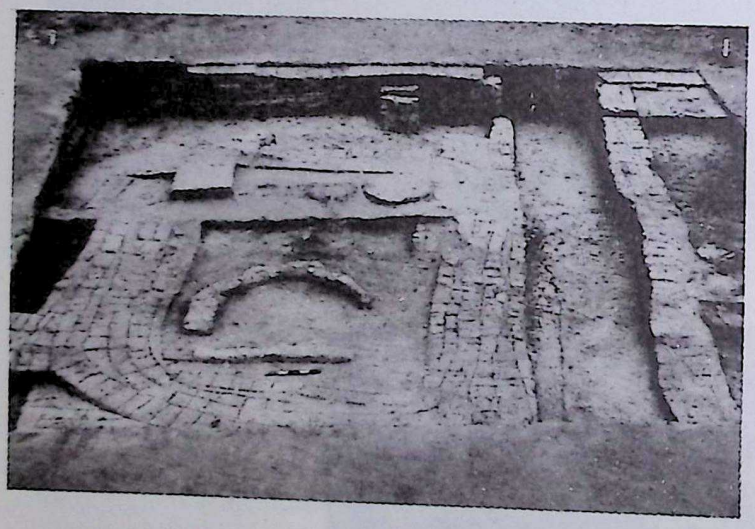

Plate 6: Banawali: Apsidal fire temple of mud-bricks

Plate 7: Lothal: Double burial

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CHAPTER XIII

Harappans and the Ṛgveda: Points of Convergence

R.S. Bisht

I. INTRODUCTION

The Āryan problem assumed a new dimension with the discovery of the cities of Harappa and Mohenjodaro of an unknown culture in the early twenties of the present century. Scholars have since been addressing themselves to questions concerning the authorship of and the factors responsible for the phenomenal birth, spread and death of that great culture which was first christened as the Indus civilization and is now widely known after the type-site of Harappa where it was first discovered and recognized. For long, it remained an isolated phenomenon with no known beginnings or end. Much of the incoherence has since gone. Now that, as a result of concerted fieldwork over decades, an almost continuous sequence of archaeological cultures starting from the early farming communities of the pre-pottery Neolithic period of *circa* 7000 BC down to the beginning of the history of India around 600 BC, has been obtained, the Harappa culture stands no longer in its majestic isolation. It is now abundantly clear that its birth was a logical culmination of a long cultural process which assimilated and accommodated multifarious elements and influences from a miscellany of the preceding cultures which were flourishing in the greater Indus valley and the upland valleys of Baluchistan and beyond. Likewise, the Harappa culture broke up into, or was followed by, a number of regional cultures. Most of the urban features disappeared in them and a few underwent a transformation or a complete change. After a long process of further deterioration in some areas and through a different process of evolution in others, those ruralized cultures of the late Bronze or Chalcolithic age dovetailed, or transformed themselves into, one or another early Iron age culture which, in turn, emerged into, or emerged as, one of the early historical cultures during the sixth-fifth century before Christ.

However, the crisis of the 'real' identity of those archaeological cultures still looms large. So far, not one of them has been incontrovertibly or conclusively identified with any age or phase known to the pre-Buddhist, that is the Vedic literature. In consequence, all the protohistoric cultures are being treated as a series of archaeological anecdotes known by their 'pseudonymous' titles given to them by the archaeologists.

This is an ironical situation as India claims an ancient, rich and continuous literary heritage of millennia and the *Ṛgveda (ṚV)* is the oldest composition of the Āryans. Since there are recurrent references in *ṚV* to the fierce battles which the Āryans successfully fought for supremacy over a host of adversaries who were described as being different in colour, caste,

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creed and language, and who are said to have been regaling in opulence and residing in forts, there was apparently a legitimate case for believing in the existence of a pre-Āryan and non-Āryan race as well. The notion readily got currency as there are peoples in India who speak languages unrelated to Sanskrit and who are supposed to be racially different from those who speak one or another Sanskrit-related language or dialect. Ever since its inception, the problem got entangled in a much bigger question that involves the concept of an Indo-European race and language. This goes back to 1788 when Sir William Jones declared a genetic relationship between the Sanskrit language and the classical Greek and Latin, hinted at 'the same origin' for the Gothic and the Celtic and also suspected the same for the Old Persian. It, therefore, became all the more easy to think of a distinct Āryan or Indo-European race which entered India as invaders from outside. The question was still unresolved when the highly advanced urban centres of the Harappans came to light. Once again the role of the Āryans came under a critical review. Many an attempt has since been made to identify one or another archaeological culture with one of the phases of the Vedic age. Diametrically opposite views have been expressed and rejected due to intrinsic contradictions, lack of coherence or consistency inherent in the approaches, or due to the appearance of fresh evidence which largely nullified the earlier inferences.

Of all the theories, the more acceptable one, particularly amongst the archaeologists, is that the Harappa culture was a pre-Āryan civilization which was probably destroyed or finally put to death by the intruding Āryans who entered India through the mountain passes of the north-west. The main argument in favour of the non-Āryan character of the Harappans lies in the concept of urban-rural dichotomy that is believed to exist between them and the Indo-Āryans in regard to their lifestyle, economy and thought. The early Vedic Āryans are generally depicted as far less civilized and as barbarian equestrians, who, before entering India, roamed about in Central Asia and the Iranian plateau and even beyond in search of pastures and fields as they mainly thrived on stock-breeding and primitive farming, and often resorted to destroying and looting the establishments of settled peoples. On entering the Indus plains, they destroyed, under the divine guidance mainly of Indra, their war-god, the prosperous cities of the non-Āryans who were described by their tribal/ethnic/community names such as *Dāsa*,[1] *Dasyu*[2] and *Paṇi*[3] and, sometimes, as *Asura*, as the followers of the god *Asura*. They are repeatedly described as adversaries and enemies by such appellations as *amitras*,[4] *śatrus*,[5] and *dviṣes*,[6] and repeatedly looked down upon as *kṛṣṇayonis*[7] (of black race or breed), and of *kṛṣṇa tvachas*[8] (black skin), *kṛṣṇas*[9] (blacks), *anāses*[10] (flat-nosed). In a verse,[11] they are denounced as *akratus* (not performing sacred rites), *grathins* (niggard), *mṛdhravachs* (babblers or defective in speech), *aśradhas* (non-believers), *avṛdhas* (not increasing the fire) *ayajñas* (offering no sacrifices), and *ayajyus* (performing no ceremonies). Elsewhere, they are called *bekanāṭas*[12] (usurers), *druhs*[13] (oppressors), *avratas*[14] (having no faith), *anyavratas*[15] (following a different faith), *adevayus*[16] (not worshipping gods), *adevas*[17] (following no gods), *muradevas*[18] (worshipping stupid gods), *śiśnadevas*[19] (phallus-worshippers), *devanids*[20] (denouncing the gods), *brahmadviṣes*,[21] *anindras*[22] (not following or without Indra as the god) and so on. Furthermore, it was believed that the Āryans were not used to city life and, therefore, unacquainted with large and fortified settlements, monumental architecture, complex trade mechanisms and seafaring, which were the essential attributes of the highly sophisticated and urban civilization of the Harappans. In addition, the religious beliefs of the Indo-Āryans were thought to be simple and naive as they worshipped the forces of nature whom they deified into gods. Thus, theirs was altogether a different world which utterly lacked the din and dazzle of the Harappan society. The contrast was, therefore, too sharp to allow any room for identification between the two peoples.

The Harappan civilization, quite spectacular and sensational that it is, notable for attaining a high degree of sophistication, standardization and utilitarianism in all spheres of

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life such as settlement planning, monumental buildings, impressive architecture, stamp seals, script, weights and measures, pottery, art, jewellery, implements and many other minor artifacts. Furthermore, it is notable for its phenomenal growth and prosperity, close cultural uniformity, mass production of crafts, complex trade mechanism, maritime trade, intercultural contacts and for enjoying a long life as well as a vast territory. In all, it indeed made a remarkable civilization. In spite of all that, it is indeed ironical that this great civilization still carries a tag of a jejune nomenclature given to it after the type-site where it was discovered first in 1921.

On the other side, the information gleaned from the *Ṛgveda (ṚV)* projects a picture of considerably civilized Āryans. They had a variety of permanent settlements and fortified towns as well as monumental structures. They were advanced in agriculture, stock-breeding, manufacture of goods and long distance trade and commerce via roads, rivers, and seas. Thus, they were a manufacturing, mercantile and maritime people having contacts with outside countries even across the sea. Their enemies whom they conquered were, of course, highly civilized too.

The above statements require substantiation. It is, therefore, imperative to make a comparative study of both the Harappa civilization and the *Ṛgvedic* culture in respect of their respective locales and material cultures.

II. CORRESPONDENCE IN CULTURAL GEOGRAPHY

1. The Harappan

In extent, the Harappan culture is found spread over a vast territory which stretches from the Makran coast and the eastern flanks of the Baluchi hills in the west to the upper Yamunā plain in the east and from the Śiwālik foothills in the north to the Arabian Sea in the south. To that should be added the land of Kachchh in Gujarat, which, as another vibrant area of the Harappa culture, lies, like the Makran coast, in the proximity of the Indus plain and is a natural area of expansion for an enterprising and seafaring community. In Saurashtra, the mature Harappan sites have been found so far in certain coastal areas only. Lothal, near the head of the Gulf of Cambay, should be one such outlying or frontier town that was founded for some specific purposes such as collection of useful raw materials, e.g., timber and semiprecious stones. Towards the fag end of their prosperous period, the Harappans had started to move along the western coast in south Gujarat and in the Tapi valley in Maharashtra and had reached as far as the upper Godāvarī valley in the Deccan where Daimabad has produced some Harappan deposits and a chance cache of exquisite bronzes, most probably of the Harappan origin. In the later phase, the Harappans were rapidly extending into the Saurashtra hinterland and the Gujarat mainland. During this period, only a few Harappan attributes survived in an otherwise regional cultural milieu that had undergone a transformation and assimilated in itself many a non-Harappan element. These regional variants seem to be the immediate successors of the mature Harappans.

In the north-east of the Harappan domain, i.e., in the Sarasvatī-Ghaggar valley, the urban and contemporary rural settlements of the mature period show themselves largely up to the 'lost' Dṛṣadvatī which is the major eastern affluent of the Sarasvatī and is now traceable in the region of the present-day Haryana and north Rajasthan. It was only towards the terminal phase that the culture was extending slowly over both the flanks of the Yamunā. As of today, no mature Harappan settlements are found further east.

The above account makes it obvious that the Indus plain, together with the adjoining Kachchh and the Makran coast, was the *terra firma* of the Harappa civilization. It was here that the affluence was attained and sustained for long. It was during this period that the frontier

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post of Lothal near Cambay, those in the Makran and that at Shortughai in the trans-Himalayan Oxus valley were established, obviously for economic reasons. And, finally, it was from here that the Harappans started to move further east and south at a time when the culture was already set on a downhill slide.

2. The Rgvedic

To look back into *ṚV*, we find a perfect correspondence between the territorial expansion of the Harappan civilization and the geographical field of activity of the *Ṛgvedic* Āryans. Physically, the latter was the land which was marked[23] by the 'eight mountains', 'the three deserts' and 'the seven Sindhus' and bounded by the Himalaya (in the north) and the sea along with the Rasā[24] (in the south). Like the Sarasvatī,[25] all these rivers should be originating in the mountains and flowing into the sea.[26]

The geography of *Ṛgvedic* India has been exhaustively discussed by Bhargava[27] who, like others, holds that the rivers vividly speak of the physical geography of the contemporary times. Of all the 'seven rivers',[28] or 'seven flowing waters',[29] or just as 'seven waters',[30] which are sometimes likened to 'seven sisters',[31] or reverentially to 'seven mothers',[32] configured the *Ṛgvedic* India and divided it into seven physical divisions[33] accommodating seven groups of peoples.[34] That is why Indra, the divine friend, protector, guide and war-lord of the Āryans, says that he holds the seven rivers flowing over the fields of the earth (X.49.9). This land of the 'seven Sindhus', which was identifiable with the *Hapta Hindu*[35] of the *Avesta* was the fifteenth of the sixteen Āryan countries, perhaps the farthest country lying in the east or south-east of the then known (Āryan) world of the Mazdaists.

(a) *The Land of Seven Rivers:* No where in *ṚV* are all those seven rivers candidly identified as such. However, there is a general consensus that the Indus and its five principal tributaries viz., the Satluj, the Beas, the Ravi, the Chenab and the Jhelum, which form what is Punjab, are surely among the said seven rivers. Those five rivers are identified definitely with the *Ṛgvedic* Śutudrī,[36] Vipāś,[37] Paruṣṇī,[38] Asiknī,[39] and Vitastā.[40] There is, however, a controversy with regard to the seventh which has been held to be the Harayu (md. Harirud), or Harahvaitī (md. Aragandab), or the Kubhā (md. Kabul), all in Afghanistan. The first two are out of question as they are not tributaries of the Indus. So far as the Kubhā is concerned, it cannot be one among the seven Sindhus in the light of the fact that the Sarasvatī emerges as one of the most (or rather the most) important river of the *Ṛgvedic* times. It is the only river[41] which evokes the utmost reverence from the Āryans who dedicated to it two complete hymns,[42] sections of four hymns,[43] and several single verses.[44] It is extolled as 'inspirer of good songs and inciter of good thoughts'[45] and can thus 'generate and illuminate with her light all intelligence',[46] and is, therefore, eulogized[47] as 'the mother *par excellence*, the river *par excellence* and the goddess *par excellence*'. That is why many scholars could not reconcile to the identification of such an important river with that desiccated stream in the present-day Haryana that goes by the name of Sarasvatī. They preferred to identify it with the Avestan Harahvaitī which flows into the land-locked lake in the Sistan. In the present situation, the Argandab is not better than the Sarasvatī of Haryana. On the contrary, in the traditional geographical as well as historical accounts in India, the Sarasvatī is identifiable with the nearly desiccated stream of the same name which flows past Bhagwanpura, Thanesar, Pehowa, Siwan, etc., and ultimately loses its identity into the Ghaggar. In fact, in prehistoric times, from about 3000 BC to 2000 BC, it was a live river with a wide flood plain stretching right from the Siwaliks to the western end of the Cholistan desert in Pakistan. Archaeologically, it is found dotted with numerous protohistoric and historical sites, including Kunal, Banawali, Sirsa, Kalibangan, Rangmahal, Ganweriwala and several others. Beyond that point, its palaeochannel is now lost in the shifting sand. However, further downstream, it becomes vivid again where it used to flow in the bed of the eastern Nara, a flood channel

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of the Indus from which the Nara branches off near Rohri. It then flows through the Rann and the Kori creek into the Arabian Sea. It can be vividly seen in satellite imagery.[48]

Traditionally, the Sarasvatī was joined by many affluents among which the Āpayā and the Dṛṣadvatī[49] were important. Their palaeochannels and also the ancient places situated on their banks are still identifiable. Furthermore, the *Nadī-sūkta* in *ṚV*[50] enumerates several rivers in the order from the east to the west. The Sarasvatī finds place after the Gaṅgā and the Yamunā and is followed by the Śutudrī and the Paruṣṇī, etc. The *Avestan* Harahvaitī is most likely to be identified with the Ṛgvedic Harasvatī.[51] The Gaṅgā and the Yamunā should be kept out of the reckoning as neither forms part of the flood plain that is carved out by the Indus and its tributaries, although efforts have been made to postulate that the latter was once an affluent of the Indus. I think, the verse[51] which refers to the Sarasvatī as 'the seventh *Sindhumātā*', meaning the seventh Mother Indus, or in other words, the seventh among the Induses, should clinch the issue.

In *ṚV*, the rivers in general are also mentioned in the stock number of ninety-nine,[52] or ninety,[53] or twenty-one,[54] without providing a specific enumeration. It is only the *Nadī-sūkta*[55] which names as many as nineteen streams (if not more), obviously arranged in a geographical order from east to west:

> Accept this my praise, O Gaṅgā, O Yamunā, O Sarasvatī, with the Paruṣṇī, O Marudvṛdhā with the Asiknī (and) the Vitastā; listen O Ārjīkīyā with Suṣomā. (5)
> For moving forward on the same chariot with whom you, O Sindhu, be united first with the Tṛṣṭamā then with Susartu, the Rasā, the Śvetī (and) with the Kubhā go to the Gomatī (and) the Krumu with the Mehatnu. (6)

While the principal rivers are already identified, the Marudvṛdhā could be the combined waters of the Chenab and the Jhelum. The Ārjīkīyā and the Suṣomā could be the Haro and the Soan of the Potwar plateau in Pakistan. They are referred to together in yet another verse.[56] Most possibly, they owe their names to the Ārjīka and the Suṣoma mountains as a source of their origins. So far, the Rasā, the Kubhā and the Krumu are concerned, they occur together with the Anitabhā and the Sindhu in another verse[57] too. On the other hand, the Gomatī is mentioned in connection with Vala,[58] a non-Āryan king or demigod, and with the migration of Narya. Of them, the Kubhā as the Kabul, the Krumu as the Kurram and the Gomatī as the Gomal are accepted as such by scholars. Now we see that the Vedic seers are talking about the rivers which meet the Indus after traversing the mountains of Kabul or north Baluchistan. Some of them originate in Afghanistan. A few other rivers of the Kabul valley such as the Suvāstu,[59] Gaurī[60] and Prayiyu and Vayiyu[61] are also mentioned. The Hariyūpīyā and the Yavyāvatī[62] should be respectively the medieval Haryub/Iryub and the modern Zhob, two tributaries of the Gomal. On their banks the Āryans conquered the non-Āryan Vṛchīvats under the leadership of Varaśikha. Furthermore, there are a few other rivers of more and lesser importance. Bhargava has in fact discussed about sixty rivers out of which about fifty are claimed to be in *ṚV*, although some of them appear to be more as adjectives or appellations. However, the land that was watered by those rivers makes itself manifest.

(b) *The Mountains*: There are frequent references to the hills and the mountains as *parvata, giri, kakubh* and *kakud*. As already stated, there is a mention of eight mountains of the earth. However, nowhere is a proper enumeration of them to be found in *ṚV*. Separately, there are references to the Himavantah (in plural), the Śaryanāvat, the Ārjīka, the Suṣoma, the Mūjavat and the Trikakuda. While the first[63] one hardly needs a discussion, the next three occur together at least at two places.[64] The Śaryanāvat, identifiable with the *Avestan Zarenumañt*,[65] sounds philologically concordant and can be located somewhere in the borderland. The Ārjīka and the Suṣoma may be the Murree hills from where the rivers named after them must be originating. The Mūjavat[66] was the area where the soma plant grew. It was perhaps the

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Mojan (Muājāvan/Mūjavān) on the northern slopes of the Hindukush. In the *Atharveda*[67] the Mūjavatas are mentioned along with the Mahāvṛṣas, the Gandhāris and the Balhikas, all the northern tribes probably living on both sides of the Hindukush. So far as Trikakuda is concerned, there is no direct reference to it. By implication, the Traikākuda āñjana, i.e., collyrium, could be possibly a product or import from the region of Trikakuda, meaning 'one having three peaks'. It may be the Trikuta Parvata in Jammu, which was once, as the tradition holds, famous for providing an eye ointment.

(c) *The Deserts*: The three deserts[68] are difficult to identify. One verse perhaps points towards a desert lying across the Parāvat sea[69] which means a distant sea. Elsewhere, one asks 'How many leagues is the desert?'[70] 'There are references', as stated by Bhargava,[71] 'like "passing over deserts", "Parjanya made the deserts passable", "like water brought to a man in the desert", "overcome by thirst in the desert", "bless us in paths and deserts" and so on'. There are also allusions to the flowing waters that moisten the deserts,[72] the Mṛgayas (perhaps the people of Mṛgaya, a non-Āryan chief) seeking their share of water in the deserts,[73] 'like a watering place in a desert',[74] the flooding of the deserts by Indra,[75] falling of rain in the desert,[76] etc. In fact, the seer of X.63.15 prays for making the desert routes auspicious *(svasti nah pathyāsu dhanvasu)*.

On the side of archaeology, there are found many protohistoric, particularly the pre-Harappan and Harappan sites lying in the desert areas of Panjab, Haryana and north Rajasthan. While the majority of them are found located along the relict channels of lost rivers or close to some interdunal depressions. One site of the mature Harappan period (Bhurtana, in district Bhiwani, Haryana) is in fact found perched upon a sand dune itself.

(d) *The Seas*: In importance, the seas come only next to the rivers and evoke much attention and affection of the *Ṛgvedic* seers. A sea is often mentioned as *samudra*, or *arṇava*. They talk of four seas,[77] elsewhere of two seas, namely, the eastern and western seas,[78] or, near and distant oceans,[79] or lower and upper seas.[80] There are references like 'the wealth coming from the sea',[81] 'ships of the sea',[82] 'sea-voyages undertaken in search of glory',[83] or 'profit'.[84] The story of Bhujyu who undertook a sea voyage and eventually met with a shipwreck and was rescued by Aśvins in 'a hundred-oared ship' is a favourite theme repeatedly narrated in *ṚV*.[85] Elsewhere, Vasiṣṭha is shown swinging in a ship in the midst of an ocean.[86] Thus, the acquaintance with the seas and seafaring of the Āryans is well attested.

Besides, there are references to dvīpas, i.e., islands in a verse[87] in which deserts are also mentioned.

ṚV mentions a special kind of body of water called *iriṇa*[88] to which a thirsty *gaura* (*Bos gaurus*) or a deer runs. Elsewhere, there is a mention of torrents flowing in an *iriṇa*.[89] In the same hymn,[90] a gambler laments that the dice agitate him just like burning coal cast into the *iriṇa*. Since the word *iriṇa* for a water body becomes rarer and almost absent in the later literature, its real meaning or identification has got lost. It is, however, possible to identify *iriṇa* with the *Eirinon* of *The Periplus of the Erythraean Sea*[91] (chapter 40 and notes thereon) and Ptolemy, according to whose description it should be the Rann that borders the land of Kachchh from three sides. This is perhaps the most plausible identification. Likewise, in one verse, there is a reference to *anūpa*[92] in connection with the cattle wealth. According to the *Amarakośa*,[93] *anūpa* should be another name of *Kachchh* which, by another word given therein, means a land surrounded by the water (*jalaprāya*).

The above account perhaps indicates that the *Ṛgvedic* people were familiar with seas, deserts, islands, the Rann and the Kachchh. They were firmly settled in the Indus valley of which the region of the Sarasvatī and its tributaries formed the eastern part. And, this alluvial plain was bounded by the Himalayas in the north and the Arabian Sea in the south. It was only the kings of the younger generation who were fighting with their adversaries on the banks of the Yamunā as well as the rivers of the Baluchi hills. The river Yamunā finds mention at three

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places only. At one place,[94] Sudas conquered Bheda, a non-Āryan king, and the tribes of the Ajas, the Śigrus and the Yakṣus perhaps sided with the latter. At the second place, Indra receives gifts of hundreds of heads of cattle and horses on the bank of Yamunā.[95] The third mention comes in the *Nadī*-hymn only. The river Gaṅgā is alluded to directly in the same hymn[96] that is dedicated to the rivers. The second time perhaps, it is mentioned in connection with the Paṇi king *Bṛbu*[97] who occupied its high bank. In the west, the Āryans were warring against the non-Āryans in the valley of Hariyūpīyā and Yavyāvatī[98] in the north Baluchistan. On the Gomatī,[99] Vala was the presiding god or chieftain of non-Āryan stock. So far as the other rivers, the Kabul or its tributaries, or some other ones are concerned, they were merely mentioned as the contributing affluents descending to meet the Indus from the hills of Afghanistan and Baluchistan.

It is noteworthy that the *Ṛgvedic* Āryans were fighting everywhere against some of the non-Āryan chieftains or peoples for obtaining supremacy which they attained finally in the land that was watered by the seven Sindhus and their tributaries, marked by the mountains, deserts, lakes, seas and islands and bounded by the Himalayas and the Arabian Sea. This alluvial plain witnessed fierce battles between the Āryans and their adversaries, the latter being pre-eminent and all-powerful before they were subjugated by the former whose control over the sea was perhaps already complete. It was towards the terminal phase of a long, glorious period the Āryans were expanding their territory towards the Yamunā and beyond. Amazingly, the geographical horizon of the *Ṛgveda* corresponds well with the geographical extent of the Harappan culture and also, to a large extent, with the pre-/Early Harappan cultures. In fact, no other archaeological culture, excepting the Harappans, is found ubiquitously distributed all over that area until we enter into the era of regular history several centuries later.

III. THE MATERIAL CULTURE

1. Harappan

Coming to the archaeological evidence, we find that the Harappa culture was preceded by a group of cultures which are referred to variously as pre-Harappan, proto-Harappan or Early Harappan. Thapar[100] has rightly stated that the last two terms 'as a culture-label would give an impression of a recognisable state in a sequence of development of Harappa culture (from adolescence to maturity), the term pre-Harappan emphasizes the stratigraphic priority and would imply an earlier or even alien or a variant culture.'

All these cultures show a strongly comparable state of socio-economic development and partaking of some interaction amongst themselves. Certain unifying forces seem to be at work. Settlements of these antecedent cultures have been found underlying the Harappan ones at several places in India and Pakistan. Many of their settlements have revealed a system of fortification with a definitive planning within the walled area, although the limited nature of excavation does not admit of adequate information bearing on those and the other aspects. Tentatively, there are four or even more regional cultures, 'styles', or traditions which are known after the type-sites of Amri, Kot Diji, Kalibangan/Sothi and Kulli, besides a few others in Baluchistan. They have their respective areas of distribution which often intersect each other. A brief introduction to some such earlier sites would be relevant.

(a) *Kot Diji* lies on the left bank of the Indus, opposite Mohenjo-daro in Sindh (Pakistan). The excavations conducted between 1955 and 1957 by F.A. Khan[101] yielded an enormous occupational deposit of about 10.35 m divisible into two periods, each sharing almost half the accumulation. Period I, which chronologically and stratigraphically precedes the Harappan settlement, was given the name after the site. The settlement was a fortified one and the structures were constructed right against the wall. The period was distinguished by its distinct

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pottery. The structures made of mud-bricks were built upon stone foundations. The entire settlement suffered at least two general conflagrations, the last being followed by the appearance of the mature Harappans who, according to the excavator, raised a settlement in two parts viz., the citadel on the higher ground caused by the antecedent deposit and the general habitation in the lower area. The earlier culture was naturally called the pre-Harappan on account of its distinct character as well as stratigraphical priority.

The material was re-studied by Mughal[102] who observed slow and steady emergence of some of the standard Harappan items from the middle level upwards and, therefore, maintained the existence of an earlier formative stage of the Harappan culture. He gave it the name Early Harappan—a term which has since got a wider currency among archaeologists working in South Asia. In conclusion, it may be reiterated that the mature Harappan settlement came into existence after a general fire that gutted the earlier one.

Since this excavation, a lot of work has been done on both sides of the Indo-Pak border. As a result, there is a general consensus that the Kot Dijian or the Early Harappan had an extensive area of distribution of which the type-site lies at the southern limit. In the north, it has been found spreading upto the Taxila valley where Sarai Khola[103] is an important site. Its area of distribution is west Punjab and upper Sindh which is generally believed to be the nuclear zone or the homeland of the Harappan culture. However, its area of influence was still larger.

(b) *Amri*, lying on a high spur on the right bank of the Indus in Sindh (Pakistan), is the type-site of a different regional culture which extends upto Sindh Kohistan , although two of its sites have since been found on the other side of the river as well. It was discovered and excavated to a limited extent in 1929 by N.G. Majumdar[104] who recognized a pre-Harappan culture underlying the Harappan. The site was also excavated in 1964 by J.M. Casal[105] who brought to light a five-fold sequence of cultures. The first period was subdivided into four phases, namely periods IA to ID, followed by two phases of period II called IIA and IIB. In ID, a few sherds, and in IIA and IIB, a few more sherds of Harappan affiliation were noticed in an otherwise continuously emerging non-Harappan cultural milieu which was given the name Amrian. After a detailed examination of the Amri material, Mughal found the Kot Diji pottery to be present right from period IB, perhaps even IA onwards. Just before the beginning of period IIA, there was noticed evidence of a general levelling and reconstruction. In period IIIA, the full-blooded Harappan culture with its distinctive pottery, architecture and other artifacts makes its appearance. Period IIIC was equivalent to the upper level of Mohenjo-daro where signs of decline are present. The later material belonging to the Jhukar period, a post-urban chalcolithic culture, was found mixed up with the still later relics of the Jhangar culture. However, the pottery of Jhukar has become well-known as representing a culture that is subsequent to the mature Harappan culture at Chanhu-daro. Subsequent excavations conducted at the type-site of Jhukar have shown that the typical Jhukar pottery had started appearing in the late phase of the mature Harappan culture and became pre-eminent after the urban phase was over. So far, no site of the Jhukar culture has provided evidence of fortification and formal planning.

While the excavation at Amri was limited in nature, the configuration of the settlement of any period could not be gathered. Although, on the basis of meagre evidence, it is suspected that the Harappan settlement had an enclosure wall. Significantly, two Amrian sites, Tharro (Tharri Gujo) and Kohtras Buthi have shown up evidence of being fortified settlements.

(c) *Mohenjo-daro*, which still remains the city *par excellence* of the Harappa culture, and also the most extensively excavated site, stands on the right bank of the Indus in Sindh (Pakistan). The site still enjoys a pre-eminent position in revealing the maximum details of the culture in terms of architecture, inner layout, pottery and a wide range of artifacts. The successive settlements have caused 12 metres of deposit over the present ground level, while additional

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7 metres lie buried under it.[106] Much of the latter lies below the water table. Some material of an earlier phase was reported to have come from certain digs in the DK area. In 1950, Wheeler[107] exposed a granary at the citadel mound and cut across the defences where he tried to fathom the levels lying in the water table. He could succeed only partially to the extent of retrieving about 3.25 metres of the waterlogged levels before he had to abandon the operation perforce. However, the results were immensely rewarding in that his excavation revealed different phases of reconstruction of the fortification wall in association with pottery and artifacts. Many decades later, his assistant Alcock[108] briefly discussed and illustrated the pottery, including the ones from the lower levels. He categorized the earlier levels into context A and B which show a gradual evolution both in forms and fabrics. It is most significant that this early pottery of Mohenjo-daro, at least typologically and in colour, corresponds fairly well with early pottery of Stages I and II of Dholavira. The problem with the Mohenjo-daro pottery is that only the shapes are illustrated and not the painted motifs, if any.

(d) *Nausharo,* in the Kachhi plain (Pakistan), is presently under excavation by Jarrige.[109] The pre-Harappan culture has four phases of which the last one is associated with a thick perimeter wall. The succeeding Harappans founded their initial settlements some distance away to the south of it. Only in the second period did they occupy the earlier mound and reconstruct the enclosure wall. In all, there are three mounds, all of which were under occupation during period III, i.e., the second period of the Harappans. Further east of the southern mound, there is a third one where there has come to light evidence of another fortification wall. The excavations have revealed the normal Harappan planning with streets and housing blocks. However, the arrival of the Harappans at the site was marked or preceded by the wholesale destruction of the anterior settlement of period ID.

(e) *Harappa,* the famous site of Harappa lies on a palaeochannel of the Ravi in district Sahiwal (earlier Montgomery) in Pakistan. The site has been excavated by several archaeologists viz., M.S. Vats,[110] M.R. Mughal and now by an American team, first headed by George F. Dales and now by Richard H. Meadow,[111] and the work is still under way. In fact, this year's (1995-96) work at the citadel mound has brought to light a pre-Harappan, an Early Harappan, a Harappan and post-urban cemetery 'H' culture in succession. Earlier, they had found an Early Harappan fortification around Mound E where they have found a substantial accumulation of the Early Harappan habitation, secured by a fortification which was subsequently used and reconstructed by the succeeding Harappans as well. During the Harappan period, the site developed into one of the biggest cities of the civilization. The post-Harappan is represented by the poorly-built houses of the Cemetery 'H' people. So far, no excavations, recent or earlier, have brought to light a later fortification.

(f) *Balakot* is situated in Sonmiani Bay, Las Bela (Pakistan). Period I at Balakot shows evidence of the existence of cultural elements of southern Baluchistan, characterized by polychrome Nal pottery style. In the upper levels of the period, this is more or less completely replaced by pottery having affinities with the early Harappan period, specially with those from Amri IC and ID. The emergence of Harappan culture, according to Dales,[112] seems to be a continuity from the previous period while a clearly marked break before the reconstruction of the mature Harappan settlement is duly present. Remains of monumental structures, all signs of incipient urbanism, in association with Kulli cultural elements are noticed in this period. The Harappan settlement seems to have followed a formal planning, marked by streets lined with housing blocks. The possibility of a dichotomous settlement with fortifications cannot be ruled out.

(g) *Rehman Dheri,* Excavations at Rehman Dheri by A. Durrani[113] in the Gomal plain (Pakistan), has revealed a different manifestation of pre-Harappan culture which is closer to that of north Baluchistan. Some Kot Diji ceramics appear in the upper levels while the

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Harappan material is absent, although the latter is present in a limited way at a neighbouring site called Hisham Dheri (400 yds.) north of Rehman Dheri.

In addition, Rehman Dheri provides evidence of a fortification which should have run on all four sides of the settlement with a formal planning of streets lined with house blocks as strongly suggested by the contours seen in an excellent aerial photograph. In my view, the settlement came to an end before the appearance of the Harappans who preferred to lay down their settlement some distance away. The possibility cannot be ruled out that the latter were responsible in some ways for the desertion of the site of Rehman Dheri.

(h) *Kalibangan* lies on the left bank of the seasonal channel of the Ghaggar which hereabout represents the old bed of the lost Sarasvatī. Geographically, it falls in the northern Rajasthan in India. The site, excavated for nine field seasons from 1961-1969 by Lal[114] and B.K. Thapar,[115] has revealed a two-fold cultural sequence viz., period I, pre-Harappan and period II, Mature Harappan. Credit goes to the excavators for providing the general configuration of the preceding as well as succeeding settlements. The pre-Harappan settlement was a fortified one designed in the form of a parallelogram measuring 240 to 250 metres from north to south and 170 m from east to west. In the succeeding period, the Harappans superimposed their citadel upon the antecedent settlement, while a part of the latter in the east was left out. Interestingly, the citadel has more or less two equal parts, segregated from each other by a massive fortification. Of course, the entire citadel is circumvallated. The southern half was enclosed by especially massive defences. Inside, there were a series of platforms. The lower town was located some distance to the east of the citadel. It was also designed in the form of a parallelogram measuring 240 metres from east to west and 360 metres from north to south, with an excellent system of streets and housing blocks. In planning, two more divisions or sub-divisions which are present at Kalibangan have been overlooked. One lies to the south of the citadel and continues at par with the southern limit of the lower town. It is not impossible that it was also fortified. The other sub-division is to the east of the lower town where a number of fireplaces were observed.

Culturally, the pre-Harappan at Kalibangan cannot be deemed to be an early Harappan in that it had different norms of architecture and ceramics as well as other artifacts, which did not linearly or genetically contribute towards the make-up of the Harappan culture. Unlike the Harappan ones, the pre-Harappan bricks here revealed a ratio of 3:2:1. The ceramic corpus also stands apart from the succeeding one. In place of long Harappan chert blades, the preceding culture yields bladelets of chalcedony. In addition, the Harappan attributes like triangular terracotta cakes are absent. Although the excavators believe that a short-lived hiatus separates the two periods, it is more plausible that the Harappans took it by storm, as is fairly indicated by the use of at least three of the walls of the earlier fortification, albeit with due reinforcement, and also in the use of pottery of the earlier period at least up to half-way through the later period, as the excavators state.

Even though the pre-Harappans of Kalibangan had maintained close contacts with the Kot Dijians from whom they had borrowed many pottery forms and decorative motifs, period I thereabout is a regional antecedent culture having its own distinct area of distribution spreading over in the middle and upper Ghaggar valley where it is represented by many sites like Siswal, Mitathal, Sothi and Banawali.

(i) *Banawali* is yet another important site[116] in District Hissar, Haryana (India). It lies on the dry bed of the Sarasvatī and upstream of Kalibangan. The first two phases of period I belonged to the pre-Harappan culture of the Kalibangan I vintage. In the second phase (period IB), the settlement was fortified by a thick wall. In the third phase (period IC), some proto-Harappan elements made their appearance in an otherwise continuing ceramic assemblage of the preceding sub-periods. This time around, the entire settlement was replanned and divided into two divisions. The preceding settlement was converted into a

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citadel, and a lower town was laid out enclosing the former from three sides viz., east, north and west. Interestingly, all the buildings, excepting the fortification wall, were pulled down and constructed *de novo*. This is proto-Harappan stage which was followed by the full-blown Harappa culture (period II) which, in its turn, flourished there for four centuries or so before the site was deserted. Period II also began with the overall reconstruction of the township while the pre-existing fortification was still used with some modifications here and there.

After a long gap, under the shadow of the earlier ruins, a small rural settlement was founded at the site by the post-Harappans, often also called the Late Harappans. By now, all urban traits had disappeared.

(j) *Dholavira*. Recent excavations[117] at Dholavira, situated in the isolated island of Khadir in the Great Rann of Kachchh in Gujarat (India), have made substantial contributions in many areas of the Harappan culture. This, one of the five largest cities of the Harappans, has supplemented and complemented profusely to what have been gathered from other excavated sites. For the first time, a full configuration, together with hitherto unknown elements of Harappan city planning, was understood. New evidence was added in respect of monumental and aesthetic architecture. An altogether new system of water harvesting and storage was brought to light. A congregation ground or stadium with seating arrangements for spectators was uncovered. In addition, fresh information bearing on funerary practices and structures is being gathered. A unique inscription made up of ten large-sized Harappan signs was discovered. Furthermore, an enormous accumulation of successive settlements of over a millennium has revealed seven significant cultural stages documenting the rise and fall of the first Indian urbanization known as the Harappan civilization.

All the seven cultural stages through which the settlement at Dholavira passed are encountered only in the castle of the citadel. The successive settlements containing residential structures and the appertenent strata account for 11.30 metres of deposit. Given below is the account of all the above-mentioned seven stages.

Stage I: The first settlement, right from the beginning, was fortified by a massive wall. The related deposit, measuring 65-70 cm in thickness, has revealed a fairly developed state of culture. The first occupants at the site were familiar with diverse pottery traditions, copper metallurgy, stone-dressing, lithic tool technology, shell-working, use of steatite and the knowledge of definitive principles of planning and architecture, all datable to the beginning of the third millennium BC. The fortification wall was made up of rubble-stones set in mud mortar. A strong cultural marker was the use of moulded mud-bricks measuring about 36 x 18 x 9 cm (providing a ratio of 4:2:1). The presence of moulded bricks, monumental architecture, indication of formal planning, perforated jars, carinated dishes, basins, triangular terracotta cakes, long chert blades, steatite wafer beads, etc., from stage I point to the beginning of the process which later blossomed into the Harappan civilization.

Stage II: The first visible evidence of the beginning of stage II was found in the form of the widening of the pre-existing fortification wall. Resting on the antecedent deposit of stage I, a 2.80 metre thick mud-brick masonry was added against the inner face of the southern arm of the fortification. Most significantly, on the inner face of the defensive wall, there were counted at least 13 coats of plaster, each made of a white, off-white, grey, or one of the shades of pink clay which are available locally. Not only the fortification but also the house walls and floors were found respectively treated with and made of similar clays. It is a trait that shows the aestheticism of the contemporary society. During this stage, the settlement, as hinted above, was extended towards the north and possibly in the east as well. This perhaps points towards the introduction of dichotomy in the settlement and thereby indicating an emerging stratification in the society or elevation of the political status of the establishment.

Among antiquities, copper items, beads of chalcedony and steatite, bladelets of chalcedony and chert, bangles of shell and clay, industrial waste of stone and shell workings and

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triangular terracotta cakes increased in number. The shell bangles continued to be thin and elegant.

Stage III : This was a very creative period at Dholavira. As in the case of stage II, its beginning too was first recognized in the further and final widening of the southern wall by way of adding 4.40-4.50 metres broad brick masonry, once again from the inside. This stage is also denoted by six building phases contained in an occupational debris of 3.30-3.60 metres which may be subdivided broadly into two sub-stages viz., IIIA and IIIB.

Stage IIIA: In this stage, the pre-existing fortress was not only substantially reinforced as indicated above, but enlarged into a bipartite citadel having a castle and a bailey. The northern extension of the residential area that came into existence during stage II was cleared of its structures and made into an extensive esplanade for a stadium which was bounded by stepped terraces meant for seating spectators. To the stadium's north, the general town was founded, and both of them were brought within one fortification with bastions, corner towers and gateways. A smaller stadium with massive walls on three sides was also laid out at the south-eastern corner of the larger one. An annexe was also in existence during this stage, although its origins, whether going back into the earlier stage(s) remains to be ascertained. Reservoirs along with partition bunds, inlet channels and dams had also been provided although provision of some of them, especially in the east, south and west of the antecedent settlements, might have come into existence right in the beginning. All these reservoirs of stage IIIA were, however, provided within a circumvallation, furnished with bastions, towers and gateways, which infact enclosed the entire city.

Stage III B: This stage followed the visitation of the settlement by a natural catastrophe, most plausibly a severe earthquake, that caused extensive devastation at the site. In its aftermath, some drastic changes were brought about in the inner layout of all the prevailing divisions, besides adding a third principal division, i.e., the lower town as well with well-defined streets and sectors. The newly added division was located to the east of the earlier town and, consequently, the city walls were also extended eastwards in order to bring it within the general, that is, the outer fortification. In addition, the monumental gates of the castle, together with their front terraces as well as a ceremonial pathway leading particularly to the north gate had been certainly built up by this sub-stage which is represented by a deposit approximating 1.10 metres as is present more or less in all major divisions of the city.

Amongst others, one of the most distinguishing traits of stages II and III, and, to some extent of stage I, is the almost universal use of colourful clays particularly of white and pink hues for making floorings as well as plasterings of both public and private structures. So much so, the broadway in the castle and the larger and smaller stadiums too were furnished successively with floors made up of such clays. The diagnostic Harappan elements, such as stamp seals, the script, weights and many typical pottery forms as well as decorative motifs, made their debut humbly yet emphatically all along during stage III. The evolving cultural scenario is also manifest in all other classes of antiquities as well as in increased craft activities and residual debitage.

Stage IV: The relics of stage IV are contained in 4.40-4.60 metres of habitational accumulation that reveals that phase of the mature urban culture which is widely well-known from a large number of excavated Harappan sites. The general planning and architecture of the preceding stage was maintained but with a few minor alterations. However, during stage IV, an overall phenomenal progress in the material culture is witnessed. Its manifestations may be seen in pottery, in the seals, in the writing, in the weights, and in a variety of ornamental and utilitarian artefacts made of metals, semiprecious stones, other stones, faience, steatite, shell, ivory, bone and clay, all found in luxuriance. Local mass production in each craft demonstrates that the city of Dholavira had become a great manufacturing centre to which

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raw materials were being brought from different sources for catering to the needs of the local manufactories as well as for supply to other centres.

The fortification network was, as a rule, entirely made of mud-bricks but for the limited use of stones for facing the outer sides of the walls. Stone was also used for the gates, drains, steps, tanks and special architectural features. In houses, it was used in the foundations as well as up to a certain height, while the superstructure would have been of mud-bricks. Quite surprisingly, with the very beginning of stage IV, the use of colourful clays for flooring and plastering went out of vogue altogether and never recurred thereafter at the site. Instead, ordinary clays were used for the purpose as everywhere else during the Harappan period.

Stage V: It is characterized by a general decline, particularly in the maintenance of the city, as is most vividly reflected in the citadel. The deterioration in other items of the culture is not easily recognizable. The classical pottery, seals, script, weights and others continued as before. Two fragments of vessels made out of soft stone, perhaps chlorite schist, are important as they should be exotic. They appear to belong to the 'intercultural style' of late phase. In point of time, they go well with the stage V.

Stage VI: The desertion of the site that followed stage V was broken by the advent of stage VI which presents a state of transformed Harappan culture, found as widely distributed in Gujarat. Vertically, its remains amount to 70 cm of thickness and provide two phases of structural activity which could have spanned a period of a century or so. The size of the settlement became substantially smaller and the layout was different. The newcomers confined themselves to the citadel and the southern margin of the middle town while the greater part of the latter and the entire lower town was not reappropriated at all. They, however, maintained the necessarily vital parts of the outer walls as well as some of the reservoirs. It was only on the north where the new occupants built a wall to defend as well as to delimit their settlement. Like the wall, the houses were also built with the stones robbed from the older structures. Bricks were no longer in use. The layout also differed drastically. A new system of streets, alleyways and housing sectors was introduced. Structures were largely rickety and jerry-built. The stonemasonry shows poor workmanship.

During stage VI many mature Harappan elements continued in use. Most of the classical pottery forms, fabrics and decorations are present in the assemblage. Some exotic ceramics, possibly coming from diverse sources, made their appearance. There is Jhukhar-style pottery perhaps from Sindh. The burnished black, grey and black-and-red pottery wares, occasionally embellished with dots and lines in fugitive white, might have come from Gujarat or Rajasthan where they were widely distributed. Among antiquities, the seals, weights, the script, beads, bangles, copper ornaments and tools, long chert blades, triangular terracotta cakes, miscellaneous terracotta objects, animal figurines and many other items of the mature Harappan traditions continued in use. But, in many cases, there are remarkable changes. For example, the seals now had only inscriptions but no figures. This was just the opposite of what had obtained in stage III when there were no inscriptions but only figures. However, the overall picture that emerges is that of progressive impoverishment and crumbling urbanism. This stage is identical with I C at Surkotada, I B at Desalpur and upper levels at Pabumath and also comparable to the several sites in Saurashtra and Gujarat. This was followed by another desertion.

Stage VII: The second desertion was certainly of a long duration as was reflected in the stratigraphy, particularly at such places where there were favourable locations for the accumulation of the eroded and collapsed debris. This ultimate habitation at the site lived for a solitary building phase. The people of this stage were living in circular stone-lined huts laid out neither in conformity to any plan nor showing any preference for a particular area.

These seven stages in fact make four distinct cultural horizons. The first comprises stages I to III, the second stages IV and V and the third and the fourth are represented by stages VI

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and VII respectively. All these are abundantly reflected in the stratigraphy, settlement planning, pottery technology and other material contents otherwise within a broad framework of one long cultural process which culminated into the Harappan culture. As stated earlier, one of the most distinguishing features of the stages II-III, and, to some extent, of stage I too, is the almost universal use of the colourful clays of white and pink hues for flooring as well as plastering for both public and private structures. No sooner did Stage IV start than the use of such clays came to a sudden stop, as if under a social taboo or a royal decree. Likewise, there seems to have been a drastic change in lifestyle, as is reflected in explicit distinctions in colour, composition and behaviour of the occupational layers. A similar situation is seen to prevail between the second and third horizons as well. The omnipresent mud-bricks, planning and monumental architecture which were the hallmark of the mature Harappan phase are no longer seen in the third horizon, although some amount of cultural continuity remained present. In sum, despite continuity, diagnostic changes are manifest from one cultural horizon to another.

The foregoing account makes it amply evident that the miscellaneous antecedent cultures flourishing in the Indus valley, Baluchistan and Kachchh were constantly evolving in all aspects and developing in their repertoire many an element which was adopted, refined in some cases, elaborated and widely distributed by the succeeding Harappans. All those early cultures had strong, comparable socio-economic infrastructures and there was regular interaction and exchange among them. Secondly, many of the sites of preceding cultures have evidenced fortification systems and inner planning. At many places, their fortified settlements were superimposed by the Harappan cities and towns which usually were of larger extent. In addition, the arrival of Harappans was quite sudden and emphatic. At many places, the earlier settlements were set on fire before the Harappan occupation started. At some sites, the Harappans seem to have levelled the previous settlements before a wholesale reconstruction in a more planned way was brought about. Evidence at Dholavira is somewhat different because the Harappans of stage IV almost scrupulously maintained the planning which they inherited from their immediate predecessors. While stage III demonstrates the early phase of Harappa culture in several ways, yet there are abundant indications that the transfer of power might not have been smooth and peaceful.

In the post-urban or post-Harappan period, the cultural scenario undergoes a sea change. The fairly unitarian character of the Harappan culture is not evident. There are a number of regional cultures in which the urban components rapidly diminish and disappear. Barring the Kachchh and Saurashtra area, fortification, formal planning, use of seals and bricks, whether sun-dried or fired, went out of vogue. The Jhukar seals are different from Harappan ones and are devoid of writing. The classical Harappan pottery forms and painted motifs disappear along with weights, triangular terracotta cakes and many other sophisticated items of art and utility. Only those pottery forms and items which were present in the pre/early Harappan phase remain in use more or less.

Now we have to look into literary evidence which should point towards the presence of a fairly advanced culture followed by a still more advanced culture and also for a situation in which both the predecessors and successors should have fortified cities and towns.

2. Ṛgvedic

When we come to the question of the material culture, we observe that the rural bias in favour of the *Ṛgvedic* economy has been unduly overemphasized and blown out of proportion. That is why, while it is largely agreed that the Āryans destroyed the forts or towns of their adversaries, it is also widely believed that they built themselves none. On the contrary, a detailed study with a more open and discerning mind and more faithful application of

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grammatical rules in respect of a host of words and sentences amply demonstrates that the Āryans, like their enemies, did possess fortified settlements of rather greater variety.

Pur

In *ṚV*, the most commonly used term that occurs for a fort or fortified settlement is *pur*[118] which should have been an impressive and strong architectural creation of great social and political importance and military necessity. A variety of adjectives that qualify a *pur* is suggestive of diversity in character in terms of nature, size, form, kind, function, etc. *Āmā*[119] might have been a cutcha fort made of perishable material like earth or mud-bricks. It may be contrasted with such forts which are qualified as *dṛḷhā*,[120] solid, strong, firm; *dṛṁhitā*,[121] strengthened; *adhṛṣṭā*,[122] not to be shaken or broken, impregnable; *aśmanmayī*,[123] made of stone; and *āyasī*,[124] made of metal, metallic, implying metal-strong forts. Some of the forts were: extensive (*pṛthvī*);[125] big, great, or spacious (*mahī*);[126] affluent (*iṣa*);[127] large and monumental as having a hundred (many) arms or bastions (*śatabhuji*).[128] One verse makes mention of protective (*partṛ*)[129] forts. In addition, such appellations for the *purs* as *śubhrā*,[130] white, bright or radiant; and *bhadrā*,[131] auspicious, are used. Elsewhere,[132] a fort of the mortals (*martyatrā*) is juxtaposed with that of the gods (*devatrā*). At one place, there is reference to a *nārmiṇī pur*[133] which can be interpreted as a rich or man-friendly fort or town,[134] and at the other, to a moveable or mobile (*chariṣṇu*)[135] *pur* of Suṣṇa. Then, there is *śāradī pur*,[136] which has been subjected to various interpretations and will be explained later. So far as *adevī*,[137] *dāsī*[138] and *dāsapatnī purs*[139] are concerned, they hardly need an explanation as they indicate their obvious affiliation with the enemy communities. Interestingly, there are two extended forms of *purs* called *parāpur* and *nipur* which occur in a ādual form in the *Vājasaneyī Saṁhitā*[140] and the *Atharveda*.[141] They have been translated as 'great body' and 'subtle body' respectively. More appropriately, they seem to stand for two different types of towns or two different divisions denoting to upper and lower towns of a single settlement. At several places, the adjective *dṛḷhā*[142] itself occurs independently as a common noun for a 'strong *pur*' which Indra shatters and breaks asunder in favour of the Āryans.

There pervades in *ṚV* a long-drawn conflict between two warring communities, one of which were the worshippers of Indra and a host of other gods through prayers and rituals, while the other ones denounced him (Indra) and some of the other gods and rituals as they had their own set of gods and beliefs. In the end, however, the Āryans came out victorious and attributed their success to their gods, particularly to Indra who stands out as the war-god. While the killing of Ahi by Indra, on the supernatural plane, symbolizes the religious supremacy of the Āryan faith, the act of setting free the seven Sindhus was that of the geopolitical control by the Āryans over the Indus plain, and the destruction of enemy forts was the most concrete and physical manifestation of their military success just as the fall of the Bastille was for the French Revolution. This is why the shattering of the towns and cities of the adversaries is a recurring theme in the hymns of *ṚV*. The grateful Āryans credited it to their gods, particularly Indra, who otherwise too, as a god of rain and thunder, with the aid of his storm-troopers, the Maruts, perpetually wages war in the sky to release the waters locked up in the clouds by Ahi, the evil force of drought, and thus rejuvenates nature and makes the land fertile with bounteous gifts for those who have faith in him. Thus, this forceful natural phenomenon was apt to be woven into the story of success inscribed by the Indra-worshipping Āryans in the land of the seven rivers where Indra, 'friendly with his friends (the Aṅgīrases), far-seeing with the far-seeing, the destroyer of cities has demolished the strong cities (of the Asuras)'.[143] Further,[144]

> Indra, who is invoked by many, attended by the moving (Maruts), having attacked *Dasyus*, and the *Śimyus*, slew them with his thunderbolt; the thunderer then divided the fields with his white-complexioned friends, and rescued the sun and set free the water.

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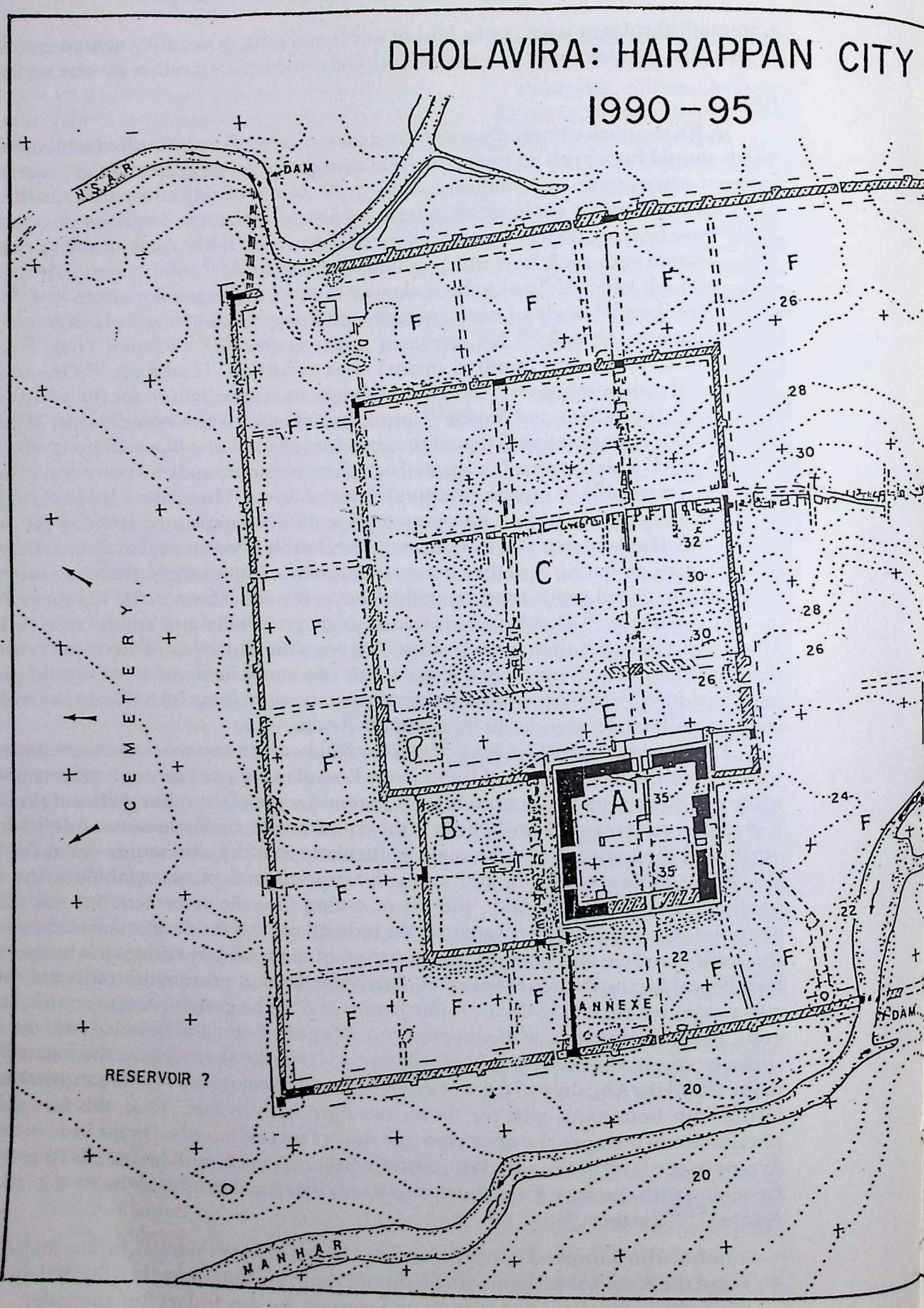

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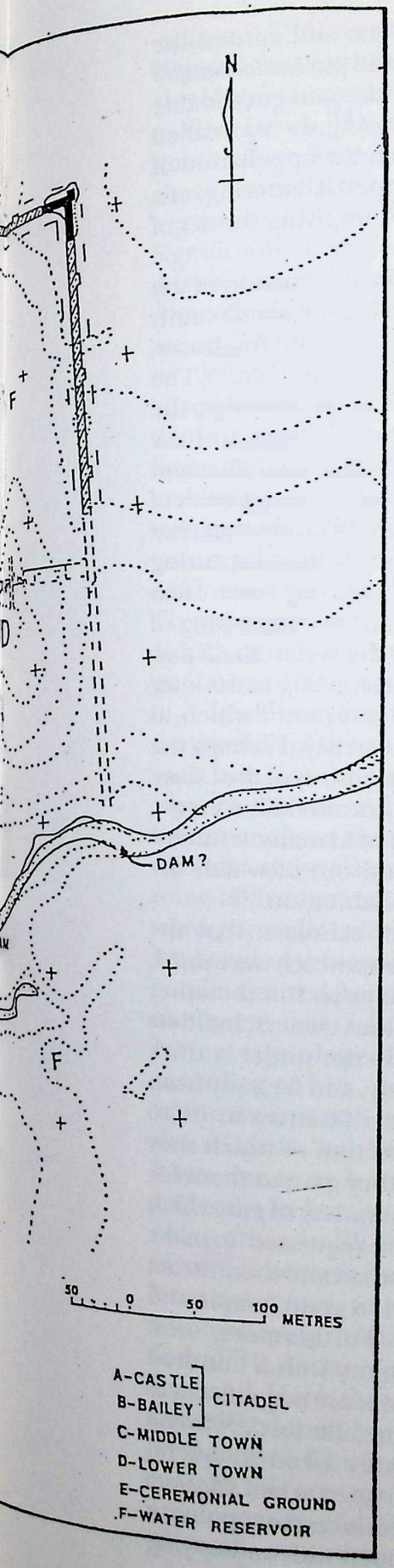

Fig. 1: Site plan of Harappan city of Dholavira.

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Indra broke asunder, shattered, destroyed (√*dṛ*)[145] the enemy forts and earned the epithet of *puraṁdara*,[146] *purām dartṛ*,[147] *purām dartnu*,[148] *purām darma*[149] and *purām darman*.[150] In the same sense, he did *bhedana* (√*bhid*,[151] *vibhid*,[152] *bibhid*[153]) of the cities and got the title of *pūrbhid*,[154] *purām bhindu*[155] and *purām bibhindu* and the act of doing so was called *pūrbhidyā*.[156] Another similar verb that is often used is *han*[157] from which the appellation of *purohan*[158] is the derivative. The verb *ruj*[159] which too means breaking open, shattering, etc. has been repeatedly employed. Similarly, there are many other verbs[160] implying the act of destruction of towns, cities or forts.

The *Ṛgvedic* poets waxed eloquent in giving inspired accounts of the destruction of the enemy strongholds. In one verse,[161] Bṛhaspati is said to have conquered foes and unfriendly people in battles, destroyed the belongings of Vṛtra and shattered the *purs*. The Aṅgirases, with the aid of the ancient friendship of Indra, forced open all cities and gates of Vala.[162] The Aśvins helped Saptavadhri in breaking through a city by force when he was oppressed by the black people[163] (Kṛṣṇa viś). Elsewhere,[164] Indra is praised for subjugating Pipru and the mighty Mṛgaya for the sake of Ṛjiśvan, the son of Vidathin, by slaying fifty thousand Kṛṣṇas and demolishing their cities. Again,[165] Indra is credited with the shattering of the strong cities of Pipru in favour of Ṛjiśvan, and, in like manner, he destroyed all the strongholds and seven cites (*purs*) of the son of Anu and gave them to Tṛtsu.[166] Indra also helped the Pūrus in capturing *śāradī purs*.[167] In another verse,[168] the Pūrus worshipped Indra for subjugating seven such *śāradī purs* belonging to the Dāsas for the sake of Purukutsa who might have been a king of the Pūrus. The same theme is repeated in yet another verse[169] wherein the seven *śāradī purs* belonged to the race of Danu (from whom the demons Dānavas sprang according to the later mythological literature). To Indra is also attributed the demolition of ninety *purs*[170] which, at another place,[171] were destroyed for the sake of Divodāsa of the Pūru dynasty. Perhaps the same ninety *purs* are also mentioned as *Dāsapatnīs*[172] obviously being the property of the Dāsas. Pavamāna Soma is also praised for rending hundred *purs* asunder.[173] Indra also killed Śuṣṇa, Pipru, Kuyava and Vṛtra and broke open the *purs* of Śambara[174] who owned as many as ninety-nine[175] and even a hundred cities[176] which were made of stone[177] and out of which the hundredth was granted by Indra to his protégé Divodāsa Atithigva for habitation.[178]

The above account demonstrates, as described by several other scholars, that the adversaries of the Āryans possessed numerous fortified towns or settlements which were *dṛḷhā*, *dṛṁhitā*, *aśmanmayī*, *śāradī* and fit for residential purposes as well, hence *veśya*. But the other side of the picture which could have shown that the Āryans too were zealous owners, builders and protectors of a variety of fortified towns and cities remained obscure under a thick encrustment caused by wrong notions that they were arch destroyers only, and far away from being and becoming city-dwellers. On the contrary, there are copious references in *ṚV* to reveal that the Āryans had a variety of walled settlements for the protection of which they earnestly entreated their gods and awarded them as eloquent titles as they gave to them for destroying the enemy counterparts. There are significant references to a variety of *purs* which obviously belonged to the Āryans. In an important verse,[179] Viśve Devāḥ are requested 'to make a cattle-enclosure protected by guards, to fabricate armour plentiful and broad and to construct *purs* metal-strong and impregnable'. In another verse,[180] Agni is invoked to grant 'ample and spacious *pur* and land which are auspicious for offsprings and sons'. Furthermore, most significantly, Agni is repeatedly prayed 'to protect against iniquity or injury with a hundred purs',[181] with a hundred protective purs',[182] 'with *āyasī purs*',[183] and 'with immense magnificences and with a hundred *āyasī purs*'.[184] Sarasvatī is also requested to be 'a firm, metallic fort'.[185] Śyena or Indra was protected 'by a hundred *āyasī purs*'.[186] Elsewhere,[187] Maruts are asked 'to defend with hundred-armed *purs* against damage or destruction' and Agni is propitiated to be a *śatabhuji pur*' for protection.[188] It is also said,[189] 'they who invoke thee (Agni) possess incessant opulence (and) dwell in a *dṛḷhā pur*'. Further, Agni 'brightens the *purs* of his worshippers with undecaying

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radiance'.[190] At yet another place, there is a reference to a *pur* of Agni[191] which was perhaps the inspired creation of his strength. That is why he imparts radiance to all auspicious or rich (*saubhagā*) towns (*purs*)[192] or a men-friendly town (*narmini pur*).[193] In another hymn dedicated to Viśve Devaḥ,[194] there is an allusion to *śubhrā purs*, i.e., bright cities and Maruts are besought not to cause decay to the *purs*[195] of the worshippers. Indra too is likened to a *pur*[196] and is elsewhere asked to be firm as he is like a *bhadrā pur*,[197] and invited 'to come to, but not to destroy, a great (*mahī*) town possessing food (*iṣa*), the cattle (*gomatī*) and valiant inhabitants.[198] Significantly, Indra is called *pūrpati*,[199] the lord of cities, who possesses 'all the cities as a husband does his wives,[200] he is, therefore, requested 'to be a saviour and protector, O Indra, our manliest Āryan chief, hold our cities' (*puro nah*).[201] Agni is compared to 'a welfare king whose valiant men are settled in *purs* and *śarmans* (most probably these two terms point to two different divisions of a settlement) as firmly as woman is bound to her husband'.[202] There is mention of persons living in towns,[203] and *paura* is the term for a townsman.[204] Indra is himself called a *paura* at more than one place.[205] In the Maṇḍala V, a poet of the Atri family bears *Paura* as a name. In a curious hymn,[206] the word *paura* occurs three times, each in the singular form of nominative, accusative and dative cases (one, can however, be in vocative case). Thus the *ṚV* provides ample material to substantiate that it contains plentiful and obvious references to Āryan forts in which townsfolk were residing, and the gods were invoked for the protection of those towns and their inhabitants. As already stated earlier, there is a reference to[207] a *pur* of gods alongside of that of the mortals. There are *purs* of Ṛta,[208] the god of the cosmic order, the purs bestowed on some devaputra[209] (which could be a proper name of an Āryan chief or an epithet meaning a favoured son of god(s)) and the *purs* of Dakṣa,[210] a well-known Āryan progenitor.

It is interesting to note, as already stated, that the Āryans, who extolled their gods for the destruction of the enemy towns and forts and conferred on the latter appropriate epithets for such acts, invoked the deities likewise for the protection and benign care of their own (Āryans') towns and forts and bestowed on them honorific sobriquets. Etymologically, the inference about the new interpretation which are going to be given now are compatible with the rules of the classical grammar governing formation of words or compound words, or with some archaic grammatical principles which were in vogue during the early *Vedic* time. The word *puraṁdhi* is formed of *puram* and *dhi*, both together meaning a receptacle, bearer or keeper of a *pur* meaning a stronghold, a fort, a town, or a city, and *dhi* is a noun of the masculine gender derived from $\sqrt{dhi}$ meaning to hold. The latter is a verb of the *Dhātu-pāṭha* and probably abstracted from $\sqrt{dhā}$ of which it is the weak form.[211] While Monier-Williams[212] gives the correct etymology of the term (*puramdhi*), he seems to err on the side of its meaning which, according to him, purports 'bearing fulness' or 'bearing a body'. The former is based on a wrong interpretation of the word *pūrbhis*[213] which is in fact instrumental plural of *pur* and should mean 'by', 'with', 'through', or 'along with' *purs*, not 'in abundance' or 'abundantly'. It was due to such interpretations that many of the *Ṛgvedic* verses[214] could not be connoted correctly. In fact, *puraṁdhi*, like *puraṁdara*, is an example of *aluk tatpuruṣa*, a compound of olden times. In *ṚV*, this epithet is given to a large number of gods,[215] including Indra.[216] Even Uṣas[217] is bestowed with this title. In addition, a separate god[218] by that name seems to have been conceived, so much so even a goddess[219] of that name was thought of. Another divine title conveying similar meaning is *puraṁdhri* in masculine and *puraṁdhrī* in feminine gender. Indra[220] is, as stated earlier, *pūrpati*, lord of forts, whom all cities attend upon as wives on the husband. Here, the word *'pati'* which means a husband should not be taken as the lord of the conquered forts but as a protector and owner who zealously guards his possessions with a benign care. This is the sense in which the *pati* was always used in the Sanskrit.

In this context, the word *purohita* may also deserve a consideration. It finds numerous references in the *ṚV*.[221] Monier-Williams[222] connote it as 'placed foremost or in front, charged, commissioned, appointed'; especially as a 'family priest, a domestic chaplain'.

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Macdonell and Keith[223] further elaborate that 'the *purohita* in all religious matters was the *alter ego* of the king'. Referring to the *Aitareya Brāhmaṇa*, they state that a king must have a *purohita*, else offerings would not be accepted by the gods. In the *Mahābhārata*,[224] Citraratha, the king of the Gandharvas, advises Arjuna to appoint a *purohita* without whom a king cannot prosper and protect his kingdom and himself. A verse in *Yajurveda*[225] demonstrates the importance as well as concern of *purohitas* in stately matters. In *ṚV*, we find Viśvāmitra,[226] Vaśiṣṭha[227] and Devāpi[228] as royal priests. Like the other priests, *purohita* invoked the gods by making offerings in the fire which was naturally placed foremost and was, in turn, the bearer of prayers and offerings to the gods and as such was the first to be invoked. Which is why the majority of the Maṇḍalas, I-VII and X, excepting VIII and IX, begin with the hymns dedicated to Agni. He is present in each household (*'dame dame'*, *'gṛhe gṛhe'*) and everywhere in the sky (*dive, dive*). He himself is a *purohita*, a *ṛtvij*, a *hotṛ*.[229] For the Āryan adversaries he is *purohan* Agni, *rakṣohan* Agni. Surprisingly, while Indra is besought for the destruction of the enemy forts, Agni is particularly, if not exclusively, invited and invoked for protection of the Āryan *purs*. He is prayed to come to a strong *pur*,[230] be an impregnable and hundred-armed *pur* for the protection of the people,[231] or be an extensive, dense and spacious *pur* for sons and successors.[232] He is also requested to brighten *purs* with undecaying radiance,[233] or to cause to shine a men-friendly *pur*,[234] or all auspicious *purs*.[235] Further, he is called the lord of the houses of all human races and implored to remain burning for hundred winters for the suppliants and protect with a hundred *purs* against iniquity,[236] or with a hundred protective forts,[237] or with brazen forts,[238] or a hundred brazen forts.[239] It is obvious that *pur*, *purohita* and Agni played important role, social, political and religious. He consumes the enemy forts and protects the Āryan ones. For the latter, he must be the presiding deity and earning the epithet *purohita*, the same way he was *purohan* for the former. And the ministrant priest who tended that fire in the citadel also came to be known as *purohita* himself too. There are some missing intervening links though, it does not appear to be an illogical reconstruction. In continuation, there are two other words which need attention. One is *purohiti*[240] which means the office of *purohita* or the act of performing duties of that office. It can be contrasted with *purojiti*[241] purporting the act of conquering forts. Besides, it is interesting to note, although not directly connected with the subject under discussion here, that *pāñchajanya purohita*[242] is another title of Agni. *Pañcha janāḥ*, frequently mentioned in the Text, stand for five clans or tribes which are suggested to have formed the Āryan society at large.

There are two other significant words: *puraḥ sthātṛ*,[243] perhaps meaning establisher of forts—a title conferred upon Indra; *puroḷhā*,[244] perhaps importing the bearer of forts or towns.

The foregoing account should firmly dispel the prevailing common belief that the Āryans only shattered the prosperous and strong towns/cities of the non-Āryans and did not own such settlements themselves. Now, it can be seen that the former as well possessed numerous fortified habitations of a large variety. We could glean twenty-seven adjectives for all kinds of *purs* whether belonging to the Āryans or to their adversaries or others. Two of them,[245] *devatrā* and *martyatrā* stand for *purs* of gods and mortals respectively and are, therefore, being kept aside. Those apart, there occur as many as fifteen terms that qualify the Āryan *purs* in contrast to only eleven or twelve in favour of the non-Āryan ones, and, amongst that too, *dṛḷhā*,[246] meaning firm and strong, is used commonly for settlements of both. The adjectives that are used for the Āryan *purs* are *dṛḷhā*, *adhṛṣṭā*[247] and *āyasī*,[248] showing their strength and impregnability; *patṛ*,[249] capable of providing protection, therefore, protective; *śatabhuji*,[250] suggesting magnitude, grandiose architecture as well as formidability; *pṛthvī*[251] and *mahī*,[252] speaking of extensiveness; *urvī*,[253] *bahulā*,[254] *saubhagā*,[255] *iṣa*,[256] *gomati*,[257] *nārmiṇī*[258] pointing to their being opulent and populous; *śubhrā*,[259] about colour or pleasing appearance, and *bhadrā*[260] for being auspicious. In later times, *bhadrā* was the term given to the citadel where the king resided. The exuberance of adjectives having

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varied meanings perhaps strongly suggests the existence of numerous Āryan *purs* of different size, form, strength and use.

Now, coming to those terms that qualified the non-Āryan forts, *dṛḷhā* and *dṛṅhitā*[261] convey the same meaning that makes them strong and formidable, *aśmanmayī*[262] tells about the use of stones or like building material such as fired bricks thus rendering a *pur* firm and impregnable, and *jarimā*[263] is perhaps employed for old, mature, time-tested *pur*. So far as the *chariṣṇu pur*[264] of Suṣṇa is concerned, it is probably a figurative statement for a strong army marching like 'a moving fort' or a settlement made of moveable tent-like structures—yurts—comparable to a moving Mughal camp consisting of elaborate equipage and equipment for setting up a royal enclosure, a darbar, enclosures for accompanying nobles, functionaries and bazar – just like a moving city or town. An *āmā pur*[265] was obviously made of perishable or less sturdy material like earth or wood or both. Before *śāradī pur* and *śarman* or *śarman śāradī pur*,[266] which should have made a special class of cities, are discussed, four of the adjectives, i.e., *dāsī*,[267] *dāsapatnī*,[268] *kṛṣṇayonī*[269] and *adevī*,[270] are just suggestive of their affiliation with the communities which are said to be non-Āryan. These are to be treated differently from the others which may, in certain cases, have been different in character. However, there is one more term, i.e., *dehī*,[271] perhaps one for a kind of, or another word for a *fort*, The verse speaks of destruction of ninety-nine *dehīs* of Śambara while, elsewhere, this word is replaced by *dṛṅhitā* at one place[272] and *pur* at the other.[273] Monier-Williams explains *dehī*[274] as a 'mound, bank, rampart or surrounding wall'. *Deha* is a word for human or animal body to which a settlement has often been likened. *Dehī* appears to be an old word as well for a settlement and perhaps survives in the present day *dehāt* for a village.

As already indicated earlier, a *śāradī pur* may have been a special type of fortified settlement. The word *'śāradī'* is obviously derived from *śarad* which means autumn but has often been used for a year as well. Scholars have, therefore, interpreted *śāradī pur* variously as an autumnal fort[275] of refuge against seasonal floods or marauders pouncing upon the city-dwellers in the season of autumn; a *pur* or castle which is rich in years, hence old, mature;[276] a temporary fort lasting only one year;[277] a perennial city[278] or a new city,[279] differently at two separate places by Wilson who has, at the third place, tried to relate such cities to some Śarad (written as Sharat[280] by him) who, according to him (Wilson), is said to be an Asura king. But nowhere in *ṚV* does one find a ground to support any of the above interpretations. Obviously, there is no unanimity among scholars on this issue. In this situation, we are tempted to hazard a guess that a *'Śāradī pur'*, like a *'śarad'*, a year, which is neatly divided into twelve months, twenty-four fortnights, so on and so forth, would have stood likewise for an articulately planned town or city. Year and months, separately and together, make an oft-repeated metaphor or symbol for time, division of time, cyclic order of time and also for the sun as well as the solar cycle.[281] At one place, the twelve months are mentioned as fruitful or prolific in offsprings.[282] Piggott,[283] while describing the layout of the Harappan city of Mohenjo-daro postulated that it might be having twelve divisions of which the west-central one was occupied by the citadel. The Harappan settlements are notable for their exquisite planning which is characterised by its cognisant street system which, in turn, determines the layout of housing blocks. Roads, streets, lanes and bylanes played a significant role in any settlement planning of the Indus people. There are a few Harappan signs of the script which are in the form of a square or rectangle having a single, two, three, four, five, six, eight, nine, twelve, fifteen, sixteen, twenty, twenty-one, twenty-five or twenty-eight compartments made by horizontal or vertical lines or by both the kinds.[284] Not unlikely that these signs or some of them stand for a variety of planned settlements secured by fortification. Significantly, one verse[285] in *ṚV* speaks of two *āpathis*, incoming streets, two *vipathis*, two outgoing or bisecting streets, *antaspathas* more than two intermediate streets or lanes and *anupathas*, more than two streets running along or in other words bylanes. It seems to indicate towards existence of a well

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defined street system which should more logically be provided in a settlement than in an open countryside. Besides, the seers also speak about bright *antaspathas*,[286] or skillfully constructed and lit-up pathways,[287] or wide roads for movement of people, the cattle and a chariot.[288] Here, we are not talking about a great variety of paths or roads which criss-crossed the countryside. We are trying to remain confined to such pathways which could have been provided in settlements – special variety of which was called, a *śāradī pur*, a planned town or city consisting of standardised residential sectors demarcated by streets, lanes and bylanes in general or having twelve divisions in particular to begin with.

Śarman and Śaraṇa:

In *ṚV* I.174.2 and VI.20.10, the occurrence of the word *śarman* concurrently with the *śāradī pur*, (albeit the former is in its most usual singular form in contrast to the latter being in the plural), appears to be highly significant. Another verse[289] speaks about the well-seated valiant persons of *purs* alongside those likewise seated in *śarman*. Elsewhere,[290] Agni is prayed to grant to his worshippers a most friendly *śarman* and protect them from insecurity with metal strong towns (*āyasi purs*). Monier Williams[291] explains *śarman* as 'a shelter, protection, refuge, safety,' as it occurs in *ṚV*. It perhaps becomes clearer when a prayer is made for granting an extensive (*mahi*) *śarman* for the people of an entire community,[292] or well-being is sought for the people of a *śarman*,[293] or protection is sought for a *śarman* housing heroes.[294] Further, invocations are made for a protection (*varūtha*) and a *śarman* for *maghavans*[295] – a term used for wealthy Āryans; *śarman* affording protection like the birds with their spread-out wings,[296] an extensive (*sapratha*),[297] a radiant (*dyumna*), a great (*mahi*) and an extensive (*sapratha*),[298] *śarman*. The *śarman* of Agni is large (*bṛhat*), great (*mahi*) and auspicious (*bhadra*),[299] and that is why he himself is *bṛhat* and *suśarman* and, therefore, the seer wishes to live in his house.[300] At one place,[301] Mother Earth is requested to be a comfortable and trouble-free home by granting an extensive *śarman*. Elsewhere,[302] the gods are prayed to grant a *śarman* which is desired to be a refuge (*śaraṇa*), auspicious (*bhadra*), free from sickness (*anātura*) and which is a triply walled habitation (*tridhātu varūthya*). The last one is of special significance to what we shall revert later. However, at yet another place,[303] the desire is for a *bahula śarman* which may stand for a dense habitation or for numerous habitations. Reference is also made to the most fortunate (*śaṁtama*) *śarman*,[304] a protective (*dhātu*) *śarman*,[305] or a flawless (one having no defect or cleft, *acchidra*) *śarman*.[306] Then, there is a *varūthya* (protected by enclosure) *śarman*.[307] *Varūthya śarman* should be of special type of which the most elaborate one was perhaps *tridhātu varūthya śarman* and as such deserved to be *śaraṇa, bhadra* and *anātura* in nature.[308]

Varūtha, Varūthya, Trivarūtha, Trivarūthya and *Dhātu* and *Tridhātu*

Varūtha appears as a special term in *ṚV* while in the later literature its meaning became much subdued and limited as a covering or a protective covering of non-architectural craft items such as boats, ships, carts, chariots, etc. In *Vedic* literature, its import is quite broad as 'protection, defence, shelter, secure, abode', although also as 'house or dwelling', 'armour, a coat of mail',[309] etc. *ṚV* contains plentiful of allusions which suggest that a *varūtha* stands for a defence and as such suggestive of a protective cover or enclosure and sometimes as a settlement itself provided with such a measure. Therefore, prayers are made that a *varūtha* is made extending (*tanve*),[310] great (*mahi*),[311] massive (*bṛhat*),[312] worthy of protection of men (*nṛpiti*) ensuring non-injury to the occupants,[313] a great protection for the movement of people[314] and a defence for all maghvans,[315] or such a secure place which cannot be assailed from whether afar or nigh.[316] In the last case, *varūtha* occurs along with a flawless *śarman*.

The word *varūthya* is more direct and suggestive. It occurs as both an adjective and a noun and means affording shelter or protection, safe, secure. Etymologically,[317] both are derivable

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from √*vṛ* which *inter alia* means to cover, screen, veil, conceal, hide, surround, enclose, etc. It should, therefore, be appropriate to hold that *varūtha* is a protective cover or enclosure and may imply, if used singly, an enclosed or fortified structure or habitation and *varūthya* as an adjective to *śarman*, or, for that matter, to any such term, should mean a settlement that is surrounded by a protective structure.

We have seen the concurrent occurrence of *pur* and *śarman* independently as well as in connection with *śāradī* – a fact most plausibly pointing towards two fortified divisions of a settlement. Furthermore, there are copious references to *trivarūtha śarman* or simply *trivarūtha*. Both seem to denote a *śarman* having triple protections or a habitation consisting of three secure divisions. The latter appears to be more appropriate in the presence of such terms as *dhātu śarman, tridhātu śarman,* more significantly *tridhātu varūthya śarman śaraṇa* which may mean a triply fortified *śarman* as *śaraṇa* that is 'refuge', or tripartite and fortified *śarman* as refuge.

There is no dearth of references in which the gods are requested to grant a *trivarūtha śarman*.[318] Amongst them, more interesting are those in which Savitṛ is asked 'to grant us for residing or habitation (*kṣayāya*), a *trivarūtha śarman* (for protection) against iniquity',[318a] or Agni is invoked 'protect us with a *trivarūtha śarman*'. Sometimes, *trivarūtha* occurs independently without qualifying any such term that may suggest a habitation or dwelling. In one such verse, Agni is prayed to make a *trivarūtha*[319a] auspicious and in the other,[319b] Indra, the most mighty, is asked to protect the Nahuṣa heroes with a *trivarūtha*.

In a more or less similar manner, the term *dhātu* or *tridhātu* occurs as an adjective to *śarman* which sometimes comes along with *śaraṇa*. As already quoted earlier,[320] a *dhātu śarman* is desired at one place; prayer is made 'to protect us with a *tridhātu śarman*' (which is translated by Wilson as 'a triply defended dwelling') at the other;[321a] similar dwelling places are sought for the donor at the third.[321b] *Śarman* and *śaraṇa* occur together as desirable blessings.[322] In yet another verse,[323] the above two are qualified by *tridhātu*. The most significant allusion[324] contains juxtaposition of *śarman, śaraṇa, tridhātu* and *varūthya*. *Dhātu* is a typical early *Vedic* word. Pāṇini took recourse to *uṇādi pratyaya* for the formation of such words. *Dhātu* is derived from verb *dhā* which means to hold, support, etc., and here that word may mean a constituent, part, division, fold, etc.[325] And, *varūtha*, as we have seen, may, rather should, stand for defences, rampart or fortification. *Tridhātu* may mean a three-fold or tripartite and *varūtha* and *varūthya* simply as fortified or walled or enclosed. Concurrent occurrence of *pur* and *śarman* on one hand, and that of the latter with *śaraṇa* on the other, seem to be good candidates for three separate divisions of a intricately fortified multi-divisional settlement the like of which may be seen in the Harappan city of Dholavira. Upto stage IIIA the citadel, the then lower town (later, middle town) and the annexe – yet another fortified one – all within an outer vallation made the three divisions. Later, in stage IIIB and through IV and V, the first two together with the newly founded lower town formed the three principal components of the city, as the annexe ceased to be an important part. Of late, Harappa is also emerging as a multi-divisioned city of which two more fortified components have since been confirmed by the recent excavation. Kalibangan too seems to be having three divisions of which that part which makes the third mound lying to the south of the citadel has never received its due acknowledgment for no explicable reason. Better planned excavation at other major sites will surely vindicate this thesis at least at some of them. In this perhaps lies the kernel of the *tripura* story – the three cities built by Maya of gold, silver and iron for the three Asura brothers and subsequently destroyed by Śiva. In fact, the constituent metals symbolically suggest their relative importance and prosperity.

It may be pertinent to record that the Āryans conceived of guardian goddesses for their *varūthya* settlements. Those are Varūtrīs, the protectresses. The god Tvaṣṭṛ together with Varūtrīs is implored 'to be our sure refuge', *suśaraṇa* and 'grant us riches'.[326a] At the other place,[326b] Varūtrīs are invoked to protect the devotees with their *śaraṇas*.

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Parama(ā), Madhyama(ā) and Avama(ā)

Now, we discuss three important words which occur in all genders depending on what they describe. Those terms are: *para, madhya* and *ava; para, madhyama* and *avama; paramā, madhyamā* and *avamā; paramam, madhyamam* and *avamam* all conveying the sense, i.e., highest or supreme; middle, middling or intermediate; and lowest or lower in each set respectively. One verse[327] says that Indra owns *avama vasu,* nourishes *madhyama* and rules over all that is *parama.* Whether *vasu* here purports riches or wealth, it, however, means dwellings as well and thus may imply habitation[328] too. Another verse[329] states that Indra is invoked in the highest, the lowest and the intermediate (stations), by those who are moving, settled, dwelling in habitations, fighting in the battle or earning wealth or food. Yet another verse[330] refers to the *avamā, madhyamā* and *paramā* earth and in the following verse[331] the above order is reversed. Elsewhere,[332] there is a mention of 'the lowest, the supreme and the intermediate protection'. Likewise,[333] there is a reference to 'the highest *dhāmans* as well as the lowest and the intermediate ones'. Then, there are mention of two-fold system which is pointed out by the highest and the lowest[334] (*parama* and *avama*); higher and lower[335] (*para* and *avara*);and high and low[336] (*para* and *ava*). In respect of the first, *parama* qualifies a *sadhastha* which means a place where people stay together – may be an assembly or settlement, most probably the latter because *avama* qualifies a *vrjana* which according to Monier-Williams[337] means 'an enclosure, cleared or fenced or fortified place' (esp. 'sacrificial enclosure;' but also 'pasture or camping ground, settlement, town or village and its inhabitants'). Interestingly, Indra is called upon by both sides of the mutually confronting enemies whether living or present in the higher or lower stations.[338] Particularly, the last two verses referred to above point towards the mundane affairs of human beings. Even in those which speak of heavenly or terrestrial divisions or stations, there is no denying the fact that men impose their system upon the imaginary world of their divinities. Or what he perceives in nature or conceives for the godly world he himself tries to translate the same on the ground where he lives. If we look at the Harappan settlement planning, we find bipartite citadels at Kalibangan,[339] Surkotda[340] and Dholavira.[341] Similarly, in the tripartite divisions of the Harappan city of Dholavira we find what the Vedic seers were trying to conceive of in supernatural and divine world.

Sadhastha and Triṣadhastha

Another type of three-fold division is indicated by *triṣadhastha*[342] (*tri* + *sadhastha*). In it, *parama sadhastha*[343] should be the highest seat or station where *adhyakṣa*[344] was the supreme authority. Significantly, there are interesting terms viz., *ekaka, dvikā* and *trikā*[345] which can perhaps be applied to settlements having a single, double and triple divisions, respectively.

Chhardis

Another special type of settlement was perhaps *chhardis,* sometimes written as *chchhardis,* which is translated by Monier-Williams[346] as a fence, secure place or residence. Most significantly, a poet seeks 'for ourselves' protection of a *śarman,* a *varman* and a *chchhardis.*[347] Co-occurrence of these three words is important as well as suggestive. As in case of a *śarman,* there are repeated references to seeking protection for such *chhardis* which is an inoffensive (*avṛka*) and extensive (*pṛthu*),[348] spacious (*sapratha*),[349] impregnable (*adhṛṣṭa*) and affording protection or protected by ramparts (*varūthya*),[350] a fortified (*varūtha*),[351] or triply protected (*trivarūtha*).[352] The god protecting *chhardis* is called *chhardiṣpā.*[353] Elsewhere,[354] protection is prayed for 'renowned', 'prosperous' and 'men-protecting' *chhardis* for the cattle, sons and grandsons. In an earlier quoted verse,[355] a *chhardis* is said to be 'inoffensive', 'extensive' and 'possessing the cattle' (*gomati*) and 'riches' (*iṣa*), and the fact that the last two terms are used in respect of the *purs* as well[356] imparts special importance to *chhardis.*

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Durga

Furthermore, there are many more other terms for settlements such as *durga, vraja, dṛḷha, vṛjana, pastyā, mahāgrāma* and *grāma,* leaving aside such words which perhaps speak of habitations just in general sense without being special in character and size. Of the above terms, *durga* is normally used in its simpler sense meaning anything that is difficult of access or simply difficulties by implication. As such, it is contrasted with *suga* meaning something that is convenient and easy. In this sense, there are repeated references to difficult as well as convenient and pleasant paths. There are, however, some allusions to *durga* which appear to suggest that it stood for a stronghold or fort as it occurs frequently in the later literature. Referring to two verses of the *ṚV,* Macdonell and Keith[357] also subscribe to this view. It is, however, doubtful whether the word *durga* in the first cited verse (V.34.7) could mean a fort. The second one[358] is more emphatic in asserting that as Indra is addressed by the worshippers to strike down in a fort the adversaries who (the mortals) oppress them. In a more explicit verse,[359] the gods addressed as *rājans* (kings) are prayed for the destruction of the *durgas* and *purs* of the adversaries as well as for putting aside the enemy's evil deeds. In a different verse,[360] *durga* occurs along with *duroṇa,* both in locative singular. *Duroṇa* often occurs in the sense of a residence, dwelling, or building, perhaps having doors. It quite usually carries the sense of its being a mansion. *Durga* might be an adjective to a *duroṇa* which is made inaccessible or located in an inaccessible place. In either sense, it appears to hold that *durga* may mean as a strong construction or fort as well. Elsewhere,[361] Maruts are requested not to harm or ruin the *durgas* (used in neuter plural). The gods are repeatedly awarded the epithet of *durgahan* for, most plausibly, removing distresses and miseries as well as for destroying *durgas* obviously of the enemies. At places, *durga* in the *ṚV* has been taken for a fort or city by several scholars both Indian and foreign, including Sāyaṇa. The occurrence of *durga* along with *pur* is suggestive of the existence of two different kinds of enwalled establishments.

Vraja

Vraja was basically an enclosure or station for the cattle and possibly for herdsmen as well. *Vraja* was another special kind of settlement which was, in importance, next to *pur, śarman* and *śaraṇa.* In the numerous mentions in *ṚV, vraja* is described as *gomat,*[362] i.e., housing the cattle. The *vrajas* are stirred by the shoes or soles of the hooves of the cattle,[363] or a *vraja* produces profuse cow milk;[364] the animals go to a *vraja.*[365] Besides being for the cattle, there were *vrajas* for horses as well.[366] Perhaps these were meant for all domesticated animals. Some of the *vrajas* should have been specially protected by enclosures, sometimes made of stones,[367] and thus meriting the title of *aśmavraja.*[368] It was such kinds of *vrajas* which are called *dṛḷha,*[369] and prayer is made to make one well protected by men.[370] It is natural that such a circumvallated *vraja* should be furnished with gates[371] which, in some examples, were as many as seven.[372] There are two interesting compound words combined with *vraja: udavraja*[373] and *śatavraja.*[374] *Udavraja* is explained by Sāyaṇa[375] as a sort of country into which the waters flow. It might be an enclosure storing water or containing a natural or artificial reservoir within a settlement or closeby. Particularly, in a land where there are no perennial source of water, a reservoir should have been an imperative necessity as has been seen at Dholavira where the Harappans made a series of tanks within the walled city and also perhaps outside.[376] The said *udavraja* belonged to the two wealth-seeking Dāsa kings, Varcin and Śambara. So far *śatavraja* is concerned, it is not easily explicable. In the entire hymn, it seems that the material aspects are intricately interwoven into a fabric in which natural phenomena as well as mythic and mystic legends and thoughts are important components. As such, *śatavraja* could be a metaphorical expression. Or else, on the material side, it could be interpreted as a land (*bhūmi*) housing a hundred (or numerous) *vrajas,* or that the *vrajas* could hold a hundred herds.[377]

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The *Harivaṁśapurāṇa*[378] contains graphic description of the *vrajas*, old as well as new one, belonging to Nanda Gopa. The *vraja*, nestled in a deep forest by the river Yamunā and close to the hillock of the Govardhana,[379] was secured by an enclosure made up of draught carts as well as thorny bushes, branches and big fallen trees.[380] The newly-founded *vraja* in Vṛndāvana was one yojana broad and twice as much long.[381] Inside, the older one was furnished with huts and houses roofed with mats, etc.,[382] with cattle stalls provided with doors duly fitted with bolting bars,[383] chariot-worthy streets,[384] enough space for the easy movement of the cattle and calves,[385] and a reservoir.[386] In sum, it was an extensive ranch within a large enclosure lying amidst pasture lands in the woods and accommodating several families of herdsmen along with their livestock under an elder. It contained wattle-and-daub houses and huts, stalls of the cattle, enough animals and a reservoir. The bullock carts were arranged outside the wooden and vegetation blockade. The *purāṇa* presents a pictorial description of diverse activities going on in the settlement: children playing; womenfolk drawing milk, churning curd, boiling butter, letting buttermilk flow, making fire, roaming about, bringing water, and so on. The selling of the milk and its produce were the mainstay. In order to enhance earnings, even the dry wood and green vegetation were sold.[387] When the pastures used to go dry and the forest over-exploited, *vrajas* were shifted to more favourable locations.[388] In the *purāṇa*, *ghoṣa* is used as synonym for a *vraja*, although, in earlier times, the former appeared to be an open animal farm in a forest – a fact that is perhaps borne out by the *Mahābhārata*.[389]

In the Ṛgvedic times and even earlier, the situation should have been nearly similar. Despite the advanced state of civilization, pastoralism was (as always all through historical times) practiced vigorously. There were fierce battles or robberies for obtaining the cattle as well as for capturing pasture lands and ranches both by the Āryans and their adversaries. There are numerous references to the *vrajas* of the former[390] as well as the latter.[391] While the Āryans have milch cows in the stone-made *vrajas* (*aśmavrajāḥ sudughā*),[392] they also seek to throw apart the gates of similar *vrajas* of the non-Āryans.[393] Further, they request that their *vrajas* be guarded by men.[394] As in the case of the non-Āryan *purs*, the cattle enclosures are also broken open and the doer is called *vrajam dartṛ*.[395] *Vṛajin*, like *vajrin*,[396] should be the lord or eldermen of a cattle farm and *vrājapati*, the lord of a group of farms,[397] who should protect them against theft.[398]

Dṛḷha

Dṛḷha has often occurred as an adjective in neuter gender to describe a firm, strong *vraja*, while it has also been used quite frequently as a noun and as such it is believed that the latter stands as well for a strong or a fortified settlement of the cattle-rearing herdsmen. One verse[399] that avers to an extensive *dṛḷha* of the cattle gives further credence to the contention. The entire *dṛḷha* fears and trembles from (the wrath of) Indra[400] who also breaks and destroys several *dṛḷhas* some of them belonging to Pipru (an Asura king)[401] and some other being made of stones.[402] Likewise, he destroys several other single *dṛḷhas*. He also shatters a *dṛḷha* in a mountain[403] (In fact, at several place, *vrajas* or simply *dṛḷhas*, located in the mountains are mentioned). Uṣas also breaks open the doors of a *dṛḷha* in the mountains.[404] Agni too spoils the wealth stored in a *dṛḷha*[405] of an enemy. Indra is prayed by his opulent friends to strengthen a *dṛḷha*.[406]

Vṛjana

Vṛjana appears to be another name or kind of settlement which perhaps wielded some power and authority as it is said to be inhabited by valiant persons[407] under a prince or a protector, called *rājan*[408] or *gopa*,[409] respectively. Sometimes, the entire *vṛjana* and the princes (*rājans*) were acquiring wealth by conquest.[410] There used to take place occasional attacks by

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the forces of the *vṛjanas*[411] and that is why divine favour was sought for protection of the *vṛjana* settlements.[412] It appears, while *vṛjana* occurring in the neuter gender should represent a settlement, that in the masculine, it might be pointing to its occupants or fighting personnel which seem to be mentioned in the fourth and the fifth references given above. This is similar to *saṁgrāma* which, both literally and figuratively, should be a congregation of villages or villagers in arms. It is, however, surprising that the fourth reference should contain *vṛjana* in the singular form and *rājan* in the plural and both in the instrumental case and as such as an agency for conquering and acquiring wealth. *Rājans* here might be denoting generals or princes assembled together as a force. A *vṛjana* provided home to many people[413] and housed milch cows and abundant wealth.[414] Sacred rites[415] were also performed there and Agni was assigned a place of eminence at the highest point.[416] Possibly, a *vṛjana*, like a few other kinds of settlements already mentioned before, had a higher and lower divisions: the former being called *parama* and the other one as *avama*.[417] Besides, there are allusions to *vṛjanas* belonging to various ruling families, while there were several others remaining unknown[418] to the authors.

Like many other kinds, *vṛjana* too was perhaps a walled settlement which was strong enough to forbid an easy trespass and is often associated with brave people under a leader – a *gopa*, a *rājan*, often undertaking military expedition and thus remaining vulnerable to outside attacks. Metaphorically, it is said no *vṛjana* was strong enough to restrain Indra.[419] The very use of word *vārayante* – $\sqrt{vṛ}$ – in the sense of stopping, holding back, or restraining may perhaps suggest that a *vṛjana* was secured by a fortification – an interpretation held by Monier-Williams[420] as well. It is, therefore, strongly plausible that *vṛjana* was a garrison post, a defensive castle, or a military cantonment sometimes having more than one divisions – all well-provisioned and occupied by warriors and their families under a leader.

At one place, a *vṛjana* of rivers is also mentioned.[421] It is not certain whether the poet was pointing towards a dam near the confluence of rivers or a settlement surrounded by rivers or, in other words, in an island.

Grāma and Mahāgrāma

Grāma and *mahāgrāma* are two other significant *Ṛgvedic* terms which more usually denote two different kinds of settlements. The former has been taken[424] as an inhabitated place, village or hamlet as well as a multitude or troop. While in one verse, Rudra is solicited 'that health may be enjoyed by bipeds and quadrupeds and that all beings in this village may be (well-) nourished and exempt from disease',[425] in the other,[426] Indra, as a leader of men, commands control over all horses, cattle, villages and chariots as well as the waters. Elsewhere,[427] the cattle and horses repair to the village. In a hymn,[428] addressed to Araṇyānī, the tutelary goddess of the forest, the deity is enquired as to why she languishes in the wilderness or whether the fear does not assail her and then she is advised to ask for a village. In the following verses,[429] the bounties of the forests are enumerated, rather most graphically shown in favour of men and animals as it provides fruits, timber, pastures and shelter to the living beings although itself is uncultivated. This shows that the villages were usually situated close to the forests on which those were heavily depended. In another lyrical hymn,[430] the motherly rivers *Vipāś* and *Śutudrī* are implored by Viśvāmitra, the sage, for letting the Bharatas, who were moving as a cattle-seeking contingent, *gavyan grāmaḥ*, pass over their combined stream by a transport chariot – *anasā rathena*. At another place,[431] *grāmas* along with chariots and cultivators, all in instrumental plural, occur together. Here, the term can be interpreted as troops as well as villages. The role of villages appear to be variable. Rather, the villagers, being primarily engaged in agricultural pursuits and animal husbandry, also served as stand-by army. And, it is why the word *saṁgrāma* which literally means an aggregate of *grāmas* had become a synonym for a troop, horde, army, or even war and battle.

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In the above circumstances, *grāmaṇī* which literally means the leader of *grāma* had a special role to play in the *Ṛgvedic* times. He may have been a civil administrator in the time of peace and an army chief in war. He, therefore, goes in front and is opulent to pay sacrificial gifts,[432] and as such is the donor of thousands, *sahasradā*.[433] His place of eminence in the royal court is attested to by the fact that he was one among the *ratnins*, the jewel-bearers, of the king.[434] A larger village was called *mahāgrāma*.[435]

To sum up, we find mention of *grāma, mahāgrāma, vṛjana, vraja, pastya, pastyā, chhardis, durga, śaraṇa, śarman* and *pur* all of which appear to be settlements of different kinds. Some types are surrounded by enclosing vallation (*varūtha*). One having a single division could be a *dhātu śarman* and the elaborate type having three divisions was *tridhātu śarman*. Even, there was *triṣadhastha* or *tridhātuni ṣaḍāṅsi*. In a few cases, each of the three components was secured by a vallation called *varūtha* and such settlements were called *trivarūthya śarman*, sometimes coupled with *śaraṇa* such as *tridhātu trivarūthya śarman* and *śaraṇa*. Such a type was alluded to even when a simple term such as *trivarūtha* was used. To this may be added *śāradī śarman pur*. That each of the terms like *parama, madhyama* and *avama* (with their different gender forms) denoted a specified division in a tripartite settlement is a strong possibility. In *Atharva-veda*,[436] the residents of the above-mentioned divisions were perhaps called *parameṣṭhins* and *madhyameṣṭhah*. The three major divisions of Dholavira designated respectively as citadel, middle town and lower town are perhaps examples of such a tripartite resolution. A more intensive search, if made at some of the other Harappan sites, are likely to vindicate this more firmly.

The foregoing account of detailing a wide range of settlements of the *Ṛgvedic* Āryans points towards the existence of a hierarchy in them. It corresponds well with a similar hierarchy in the Harappan habitations although the matter of specific equations will largely remain a moot point as it would be difficult to attain. The main obstacle would be the obsolescence of terms in many cases, or contraction or expansion of meaning in a few others in the later-day Sanskrit. Reverting to the Harappan context, we find very small sites like Balu, Surkotada, Pabumath and Mitathal, very extensive ones like Mohenjo-daro, Harappa, Ganweriwala, Rakhigarhi and Dholavira and a long range of intermediate ones of varying sizes and configurations like Banawali, Lothal, Kalibangan, Nausharo, etc. In the majority of the cases, there is more than one divisions. If excavated under an intelligent planning, each of the divisions may be found enclosed within a fortification. At a better preserved site like Dholavira, there may be found more than one walled enclosures attached to the city walls for housing subservient set-ups or/and a cattle farm. In the light of the above, it is ver antalizing that the Dholavira citadel, middle town and lower town are the *parama, madhyama* and *avama* divisions respectively and which, in the same order, can be equated with *pur, śarman* and *śaraṇa*, albeit with no foolproof certainty. *Vraja* should be more a settlement of animals and husbandsmen, *vṛjana* could be more as a military establishment and *chhardis* might be a hamlet consisting of hutments.

A Brief Comment on Architecture, Private and Public

Hierarchy, functional diversity and monumentality in both habitations and buildings are, among other things, the requisites of an urbanized society. Presence of those qualities in respect of the former is now fairly attested to and it is, therefore, imperative that this should be looked into in respect of the latter as well.

There is found in *ṚV* a long and impressive list of terms which certainly concern architecture. Some appear to be general terms for dwellings and some for specific types.

In the first category, there are several words which seem to be abstract forms for homes and houses. Those are: *gṛha*;[437] *dan*;[438] *dama*;[439] *dhāma* or *dhāman*;[440] *kṣaya*;[441] okas;[442] *vasati*;[443]

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niveśana;[444] and *nīḷa.*[445] Besides, there are a few more words which should have been used for dwellings.

Dur, Duroṇa, Duryoṇa, Duroka and Durya

Such are words like *dur, duroṇa,* and *duryoṇa* and sometimes *durya.* Literally, *dur* means a door and the remaining words are formed in compound with it and, therefore, should represent such buildings which are equipped with doors. As it is well known that building should normally be fitted with doors, then the question arises as to why the provision of a door in a construction should be underlined so specially. There are references to the breaking open of the doors of the forts of Vala,[446] or those of a strong *vrajarich* in kine,[447] or of the *vrajas* made of stones,[448] or a stronghold,[449] of the *paṇis,*[450] of a hostile Mānuṣa, a descendent of Manu.[451] One verse says that Indra destroying by his prowess the phallus-worshippers, knew of (the wealth concealed in a stronghold) with the hundred gates.[452] Interestingly, elsewhere, Indra throws open all his gates of a great self-ruling ranch which he himself nurtures.[453] This account betrays that *dur* was not an ordinary door of common houses, but it stands for a strong, protective gate of a stronghold, a town, an enclosed ranch, or a city – the kinds of ones may be seen at the city of Dholavira. A fort having hundred doors also points towards the existence of a formidable fortification pierced by multiple gates. This kind of urban or military scenario can very well be visualized in the ruins at Dholavira.

In the light of above, it will not be impertinent to hold that the words *duroṇa, duroka, duryoṇa, durya,* and *duryā* stand for a special class of structures which may have been equipped with imposing and strong gates through massive walls without which the provision of special gates howsoever strong would have become infructuous. Further credence to it is lent by some of the allusions. At one place,[454] *duroṇa* is qualified by *durga* which here seems to purport a fastness. At another place,[455] Agni is called or likened to *viśpati,* chief of community, who looks after his subjects in (or from) his *duroṇa.* At yet another place,[456] as a *śarmasad* or townsman, it is said, feels contented in a *duroṇa.* Elsewhere,[457] Indra is said to have deposited the lesser and the greater wealth in the mansion (*duroṇa*). There are, however, several references in *ṚV* to *duroṇa.*[458] *Duryoṇa*[459] also seems to be a variant of *duroṇa* and similar is perhaps the case with *duroka.*[460] The next word *durya* literally means belonging to the door and hence a house,[461] or it may also mean a castle, a mansion or fort. Among others,[462] in one case,[463] the seer wishes to live in *duryās* filled with progeny or people.

Harmya

Harmya[464] is another kind of building which is encountered several times in the text. Although, the references are nearly mute about its size, form and functions, yet Macdonell et al hold it as 'the Vedic house as a unity including the stabling and so forth, and surrounded by a fence or wall of some sort'.[465] However, he is perhaps not off the mark because *harmya* as a residential building appears in the later literature as a monumental structure or mansion. Macdonell et al, elsewhere, opine that a *harmya* was a house of considerable size having several rooms for the family together with the cattle and the sheep and further add that it could be securely shut up.[466]

Sadman

Sadman,[467] sometimes written as *kṣadman,*[468] is yet another kind. These are mundane (*pārthiva*)[469] as well as divine (*divya*[470] or *daivya*[471]). Of the latter, Agni has measured a *sadman* for himself,[472] another is of Ṛta[473] and so on. Such divine *sadmans* may have been a reality as shrines dedicated to the concerned gods. In fact, *sadmans* are quite usually associated with religious functions, as the priest lops the sacred grass in it;[474] a *hotṛ* leads to it a sacrificial

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animal;[475] Agni is a kind priest in sacrificial halls where all concurring men bearing the clipped sacred grass have assembled,[476] Agni himself is a *sadman hotṛ*.[477]

Some *sadmans* were great (*mahi*),[478] long and broad (*dīrgha* and *pṛthu*),[479] as also spacious (*urviyā*).[480] Referring to the resplendent *sadmans* (*śukrasadmans*) which were provided with huge pillars to support the firmament above,[481] it can be inferred that some of the assembly halls were coloured with bright white colours and were furnished with columns which supported the roof. At the top, there may be fluttering a flag.[482] *Sadman* was an usual, rather special and favourite structure, which, therefore, finds frequent allusions in the text.

Some *sadman* should have been quite monumental and thus meriting to be called *dīrghaprasadman*.[483] Another interesting feature is that some, or all, distributed sweetmeats or palatable food, hence called *svādukṣadman*.[484] It, however, seems certain that these were predominantly religious structures having pillars to support them. This reminds one of the large columnal hall in the citadel of Mohenjo-daro.

Sadana and Sādana

Sadana[485] and *sādana*[486] are two other frequently mentioned terms. Like *sadman*, both are derived from the root *sad* which means to sit or be seated, and likewise appear to be public or private buildings meant for public use, particularly on religious occasions. It is, however, admitted that the religious use of these two kinds are not so pronounced as in the case of *sadman*. At places, mundane and divine *sadanas* are specified separately. A *sadana* of men (*nṛṣadana*)[488] is also mentioned, and, at one place, the term *niṣadana*[489] occurs as well. The latter points towards a place of worship under the *aśvatha* tree. These constructions were done with technical finesse (*dhiyā kṛtam*)[490] with set standards of measurement (*devamānam*).[491]

Sadas and Saṁsad

Sadas and *saṁsad*, perhaps not much different from each other, are derived from the same root *sad*, and appear to be important institution(s) which were possibly run in or from specially constructed buildings which were sometimes quite monumental in character. Mitra and Varuṇa, who are said to be mighty kings (*rājan*), are shown as seated in their firm and most elegant *sadas* with a thousand pillars.[492] Elsewhere,[493] Indra and Varuṇa are addressed as kings who embellish in celebration all their three *sadases*. At another place,[494] the same deities, of whom one supports the *kṛṣṭīs*, (the cultivators or subjects) and the other destroys the belongings of Vṛtra without resistance, is offered *soma* in the assemblies (*sadahsu*). At yet another place,[495] strong *sadases* of Rakṣases (demons) are rent asunder. In one example[496] which appears to bear some information of exceeding significance, the seer worships in the *sadas* of Ṛta, the lord of the universal order, 'where the mother and the daughter, two productive milch kine, unite; they nourish each other'. All these averments strongly point towards the association of a *sadas* with royalty, administration as well as monumental grandiose and multi-divisional aspect. References suggest that these establishments are as much Āryan as non-Āryan. Furthermore, the last-quoted verse reminds one of the bipartite character of the citadel as can be seen at Kalibangan, Surkotada and Dholavira. The simile of mother and daughter cows, both productive with milk and joined together (*samīcī*) and being located in the same *sadas* or division is most appropriate for the 'castle' and 'bailey' forming together the citadel of the Harappan settlements of all three of the aforesaid sites.

Saṁsad

Saṁsad is copiously alluded to similarly. *Saṁsads* of Vāstoṣpati, the presiding god of architecture or dwellings or buildings, are comfortable[497] and Agni lives in a strong *saṁsad*.[498] Significantly, the seer demands that all 'proclaim in our *saṁsads* those perpetual and ever new riches which the slayer of Vṛtra has brought from afar'.[499] *Sapta saṁsads*, seven assemblies, are

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mentioned in one verse,[500] and *svādusaṁsad*, meaning an assembly of palatable viands, in the other.[501]

Sabhā, Samiti and Vidatha

Sabhā, samiti and also *vidatha* were important politico-social institutions for which, particularly the first one, there may have been a special structure in which official business transactions as well as games were carried out by the elite. We are not going to discuss them as a lot has been written about them.

All the above mentioned terms which are used in *ṚV* for architectural forms of buildings, private or public, religious or secular or both combined, indicate that there should have been a multiplicity in size, form and function. The use of several terms – a basic word denoting an architectural form as well as its derivative and also its occurrence in compound with some other technical words or an adjective, e.g., *dur duroṇa, duryoṇa; durya* and *kṣaya* and *urukṣaya; sadman dīrgha sadman* and *dīrghaprasadman; sadana, niṣadana* and *nṛṣadana; saṁsad* and *svādusaṁsad*, etc. – makes the multiplicity or plurality as well as the hierarchy obvious. The same is reflected in the case of settlements. Besides, it is also evident that, while some types of building forms as well as settlements were exclusively Āryan, quite a few of them were surely of non-Āryan origin which the former inherited and might have modified according to their requirements. This is why, the later *Vedic*, epic and *purāṇic* literature is replete with the episodes which extol the Asuras as mighty builders of towns and palaces.

We may here cite a few examples which exhibit architectural proficiency of the Āryan builders. We have seen the references to the firm and finest *sadas* with a thousand pillars,[502] and to a settlement or house having a hundred doors.[503] There are allusions to a house with a thousand doors,[504] to a mansion with a thousand columns,[505] a huge column supporting the firmament,[506] i.e., the roof, a construction of six pillars,[507] columns of copper,[508] a house raised in the sea,[509] an elaborate (*citra*) house constructed with divine standard and compared to a pond (*puṣkariṇī*).[510] These are examples which demonstrate the presence of elaborate, elegant, articulately built houses. Does not the comparison of a house to a pond indicate that such tanks were sometimes alongside or within a building, the kind of which we see in the elaborate structure containing the Great Bath at Mohenjo-daro. At Dholavira too, a larger tank for storage of water drawn from a well has been unearthed at the castle. Alongside it, there is found a smaller one which was possibly used for bathing purpose. This evidence at Dholavira reminds one of the *puṣkara* of *ṚV*, which, besides being lotus, means a water pool, a tank, as well. The Dholavira evidence of the tank and well is nicely reflected in one of the verses of the *ṚV*.[511]

Essentially, there should have been a definite set of principles of selection and preparation of ground, deciding orientations, doing measurements, layout and construction. Significantly, there is conceived a separate god called Vāstoṣpati for presiding over planning and architecture or the science of construction, and Tvaṣṭṛ is the divine craftsman or builder. Sometimes, both appear to be the same god.[512] The mansions of Vāstoṣpati are opulent and he keeps *yoga* and *kṣema* of all men;[513] he discovered all forms.[514] He is invoked to be an excellent abode and auspicious for both bipeds and quadrupeds.[515] He is keeper of rules or principles[516] which are essential for a planner and architect. There is a verse of exceeding importance, which inquisitively seeks to ask, in connection with the performing of a sacrifice by all the gods to the supreme god, as to 'what was *pramā* or *pratimā;* what (was) *nidāna;* what was *ājya;* what was *paridhī;* what was *chhandas* or *prauga* and what was *uktha*?'[517] All these are surely technical words relating to performing a sacrifice or raising an altar, therefore and likewise as much to architecture. In both *pramā* and *pratimā* which are nouns in feminine form '*pra*' and '*prati*' are prefixes respectively added to the root '*mā*' which, in turn, means 'to mete out' or 'measure'. Monier-Williams *inter alia* explains *pramā* as basis or foundation, while

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pratimā as a creation, image, idol, or even extent and measure. It is more logical to explain both the terms as measuring or measurement on horizontal and vertical planes respectively. The third term, *nidāna, inter alia* means a band, rope, halter.[518] It can, therefore, be considered as the measuring rope. A verse in *ṚV* says of letting loose the *nidāna* or fetters of the kine.[519] The fourth word is *ājya,* which in the ritual parlance, is the clarified butter offered in the fire.[520] But the basic word '*aja*', besides being for the goat, also means beam of the sun.[521] This as such may as well be taken as a lineal alignment. In the architectural treatises, orientation is determined by the movement of the sun as it is observed on the day of the summer or the winter solstices. The orientation of the Harappan settlements also points towards the existence of two different reference points for determining orientation. However, if we come to *paridhi,* it means a circle or cicumference in geometry, an enclosure, fence, or protection in architecture, and the three fresh sticks laid round a sacrificial fire in ritual,[522] etc. As an architectural term, it occurs severally in *ṚV.*[523] Similarly, the *chhandas* in this verse has a two-fold meaning or occurs as an allegorical term. Generally, it means, a metre or metrical science. As metre it is beset with the arrangement of syllables. This is why, in the later architectural jargon, it has been used as a scheme, pattern or arrangement of a building – as *talachhanda,* it is the layout of plan on the horizontal plane; as *ūrdhva-chhanda,* as the resolution over elevation on the vertical plane. The term *prauga* is a very significant and interesting word which in geometry stands for a triangle and therefore as well for any triangular form, particularly for the forepart of a chariot or cart, and in the litany, it is the second hymn that is recited at the morning libation.[524] *Prauga* plays a significant role in planning out for architecture. For making a square, rectangle, rhomb or parallelogram, two triangles are joined together on a common diagonal hence called *ubhayatah-prauga* – a triangle by or on both sides. Its formation has belied any satisfactory etymological solution. We, therefore, hazard a guess that it is made up of three abbreviations viz., *pra, u* and *ga.* According to the *Śulba-sūtras* – formulae of *śulbas* (measuring ropes) (in other words formulae of architecture by implication)—a triangle on the ground is drawn by stretching the measuring rope from a peg driven at an appointed place falling on the predetermined line of orientation towards the east upto the point of desired length, and then from that point the rope is stretched towards the north for a desired length and then from there the rope is drawn back to the starting point. In the light of the above, it is postulated that '*pra*' is the abbreviation of *prañch* or *prāchī,* '*u*' for *udañch* or *udīchī,* meaning the east and the north respectively, and '*ga*' for '*gamanārthe ga*' implying the point of start to which the rope is stretched back. If this is true, it well nigh suggests that the *Ṛgvedic* architects had developed working principles of geometry. Now comes the last one, namely, *uktha* which means a saying, sentence, verse, praise or eulogy grammatically, a recitation of verses in contradistinction to the *sāman* and the *yajus.*[525] It is not unlikely that in the present allegorical context, the *uktha* perhaps stands for a combination of geometrical forms and arithmathic computations used for helping draw up details of layout.

The entire verse is infact an intelligently woven allegory. *Pramā, pratimā, paridhī* and *prauga* are surely geometrical and architectural terms besides being the ritual. *Chhandas* by way of expansion of meaning as we find in the later literature could have been an architecture term, while the *nidāna,* the *ājya* and the *uktha* are sacerdotal terms which seem to have been used metaphorically for architectural purport. In fact, the entire hymn (*ṚV,* x.130) seems to be an allegory in which quite a few architectural terms and principle are interwoven. In the first two verses, the weaving makes the simile for the fabrication of a sacrifice. The metres of *gāyatrī, uṣṇik, anuṣṭubh, bṛhatī, virāj, triṣṭubh* and *jagatī* were recited for different gods at the time of the primeval sacrifice as found in the fourth and the fifth verses. Those were the *chhandases* together with eulogies, with which the seven divine seers conduct the sacrifice, like a charioteer does (a chariot) by holding reins. These seven seers may have been the seven bears,

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majoris or minoris – the heavenly bodies which could have helped in determining orientation, as well as time.

NOTES AND REFERENCES

Note: The Sanskrit verses cited hereunder, if not indicated otherwise, are from the *Ṛgveda Saṁhitā* (*ṚV*), H.H. Wilson, reprinted by Nag Publishers, Delhi, 1977.

1. a. दासा॑ च वृ॒त्रा ह॒तम् VII. 83.1.
   b. पुरो॑ विभि॒न्दन्नच॑रद् वि दासीः I.103.3.
   c. स वृ॑त्र॒हेन्द्रः॑ कृ॒ष्णयोनीः पुरं॑द॒रो दासी॑रैरय॒द् वि II.20.7.
   d. इन्द्रा॑ग्नी नव॒तिं पुरो॑ दा॒सपत्नी॑रधू॒नुतम्। III.12.6.
   e. मंन्दसा॒न आ॑रूजः। पुरो॒ दासी॑रभीत्य॑। IV.32.10.
2. a. दस्यू॒च्छिम्यूं॑श्च पुरुहू॒त एवैर्ह॒त्वा पृ॑थि॒व्यां शर्वा॒ नि ब॑र्हीत्।
   सन॒त् क्षेत्रं॒ सखि॑भिः श्वि॒त्न्येभि॒ःसन॒त् सूर्यं॒ सन॑द॒पः सु॒वज्रः॑॥ I.100.18.
   b. अ॒नासो॒ दस्यूं॑रमृणो व॒धेन॒ नि दु॑र्यो॒ण आ॑वृणङ् मृ॒ध्रवा॑चः॥ V.29.10.
   c. इन्द्रे॑षिता अ॒भ्यव॑र्तन्त॒ दस्यू॑न् V.31.5.
   d. पुरो॑ जघन्वां॒प्रती॑नि॒ दस्योः॑ । VI.31.4.
   e. प्रप्रतान् दस्यूं॒रग्नि॑र्वि॒वाय॒ पूर्व॑श्च॒कारापरां॒ अयज्यून् VII.6.3.
   f. अ॒न्यव्र॑त॒ममा॑नुष॒मयज्वा॑न॒मदे॑वयुम्।
   अव॒ स्वः सखां॑ दुधुवीत॒ पर्व॑तः सु॒घ्नाय॒ दस्युं॒ पर्व॑तः ॥VIII.59.11 & AV.92.11.
   g. cf. I.51.5; IV.38.1; VIII.87.6; X.47.4; X.48.2; X.99.7.
3. a. न्य॑क्रतून् ग्र॒थिनो॑ मृ॒ध्रवा॑चः प॒णीं॑रश्र॒द्धाँ अ॑वृ॒धाँ अ॑य॒ज्ञान्। VII.6.3.
   b. इन्द्रो॒ विश्वा॑न् बेक॒नाटाँ॑ अह॒र्दृशं॑ उ॒त क्रत्वा॑ पर्णी॒रभि। VIII.55.10.
   c. समी॑ प॒णेर॑जति॒ V.34.7.
   d. ज॒ही न्य१॒त्रिणं॑ प॒णिं वृको॒ VI.51.14.
   e. अरो॑दयत् प॒णिम् X.67.6.
   f. Also V.51.3; VI.20.4; X.108; etc.
4. I.63.2; VI.73.2; etc.
5. VI.73.2; VIII. 85.16.
6. I.41.3. VI.61.9.
7. II.20.7 C see note I.c.
8. I.130.8; घ्नन्तः कृष्णामप॒त्वच॑म् IX.41.1.
9. a. प॒ञ्चा॒शत् कृ॒ष्णा नि व॑पः स॒हस्राऽत्कं॒ न पुरो॑जरि॒मा वि द॑र्दः IV.16.13.
   b. पुरं॒ न धृष्णु॒वा रुज कृ॒ष्णया बाधि॒तो वि॒शा। VIII.62.18.
   Wilson opines that it probably refers to distress caused by "the black people' (1977, p. 297).
   c. VIII.85.13-15, probably refer to a non-Āryan king, namely Kṛṣṇa who was defeated along with his army of ten thousand.
10. Cf. 2b.
11. Cf. 2e & 3a.
12. Cf. 3b.
13. I.121.4; VII.16.8.
14. IX.41.2.
15. V.20.2 cf. 2f.
16. VIII.59.11.
17. III.1.16; X.138.4.
18. VII.104.24; X.87.2, 14, 19.
19. VII. 21.5; X.99.3.
20. VI. 61.3.
21. VI. 52.2-3; VII. 104.2
22. I.133.1.

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23. अष्टौ व्यख्यत् ककुभः पृथिव्यास् त्री धन्व योजना सप्त सिन्धून् I.35.8.
24. यस्येमे हिमवन्तो महित्वा यस्य समुद्रं रसया सहाहुः। X.121.4.
25. a. गिरिभ्य आ समुद्रात् VII. 95.2.
    b. इंवारुजत् सानु गिरीणां VI. 61.2.
26. a. समुद्रं न स्रवतः सप्त यह्वीः। I.71.7.
    b. I.190.7.
    c. समुद्रेण सिन्धवो यादमाना III.36.7.
    d. त्समुद्रे न सिन्धवो यादमानाः VI.19.5.
    e. समुद्रायेव सिन्धवः। VIII.6.4.
    f. समुद्रमिव सिन्धवः VII.6.35 & VII.81.22.
    g. राजा समुद्रं नद्योऽविव गाहतेऽपामूर्मिं संचते सिन्धुषु श्रितः IX.86.8.
27. M.L. Bhargava, *The Geography of Ṛgvedic India* (Lucknow, 1964), 129-31.
28. a. अस्य श्रवो नद्यः सप्त बिभ्रति I.102.2.
    b. मृजन्ति त्वा नद्यः सप्त यह्वी॥ IX.92.4
29. a. Cf. 26a; 28b.
    b. अहं सप्त स्रवतो धारयं वृषा X.49.9.
30. सप्तापो देवीः सुरणा अमृक्ता याभिः सिन्धुमतर इन्द्र पूर्भित् X.104.8
31. a. सप्त स्वसारो I.191.14.
    b. यः सिन्धूनामुपोदये सप्तस्वसा स मध्यमो VIII.41.2.
32. a. सिन्धुभिः सप्तमातृभिस् I.34.8.
    b. सप्तशिंवासु मातृषु I.141.2.
    c. आपो मातरः सप्त तस्थुर्नृभ्यस्तरायं सिन्धवः सुपाराः VIII.85.1.
33. a. पृथिव्याः सप्त धामभिः I.22.16.
    b. X.122.3.
34. यो अग्निः सप्तमानुषः श्रितो विश्वेषु सिन्धुषु। VIII.39.8.
35. The *Zend-Averta, Vendidad*, I.19, Tr. by James Darmesteter, published by Atlantic Publishers & Distributors, New Delhi-1990.
36. III.33; X.75.5.
37. III.33; IV.30.11.
38. IV.22.2; V.52.9; VII. 18.8; VIII.63.15; X.75.5.
39. IV.17.15; VIII.20.25; X.75.5.
40. X.75.5.
41. अम्बितमे नदीतमे देवितमे सरस्वति II.41.16.
    Sarasvatī has been repeatedly invoked as one of three most revered goddesses—the other two are either Bhārati and Mahī or Mahī and Iḍā.
42. VI.61 and VII.95. In the latter, the third verse is dedicated to Sarasvān who may either be a male counterpart of the river-goddess or a lake on her bank or at the mouth of the river.
43. I.3.10-12; II.41.16-18; VII.96.1-3 (the verses from 4 to 6 are dedicated to Sarsvān (Sarasvatī); X.17.7-9 (while the following verses from 10 to 14 are dedicated to the waters).
44. Bhargava 1993:91.
45. चोदयित्री सूनृतानां चेतन्ती सुमतीनाम्। I.3.11.
46. महो अर्णः सरस्वती प्र चेतयति केतुना। धियो विश्वा वि राजति I.3.12.
47. Cf. note 41.
48. Yash Pal, et al. 1984. Remote Sensing of the 'lost' Sarasvatī River, in Frontiers of the Indus Civilization' (B.B. Lal and S.P. Gupta, eds.), Delhi, 491-497.
49. दृषद्वत्यां मानुष आपयायां सरस्वत्यां रेवदग्ने दिदीहि III.23.4.
50. X.75. 5-6.
51. बृहस्पते यो नो अभि ह्वरो दधे स्वा तं मर्मर्तु दुच्छुना हरस्वती II. 23.6.
    The adjective duchchhunā which is interpreted by Monier-Williams (1987-484) as from *dus* and *śunā*, together meaning 'misfortune, calamity, harm, mischief', indicates that the Harahvaitī is looked down upon probably for the reason that it was a river which provided home to those who were opposed to the *Ṛgvedic* Āryans. Harasvatī should be the river which watered the tenth Āryan land and/or country named

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after it in the *Avesta* (*Zend-Avesta, Vendīdād*, I.13).
सरस्वती सप्तथी सिन्धुमाता VII.36.6.

52. a. नवं च यन् नवतिं च स्रवन्तीः I.32.14.
    b. नवानां नवतीनां विषस्य रोपुंषीणाम् I.191.13.
53. a. वि ते वज्रासो अस्थिरन्नवतिं नाव्या३ अनु I.80.8.
    b. प्रास्य पारं नवतिं नाव्यानामपि कर्तमवर्त्योऽयज्यून् I.121.13.
54. a. त्रिरश्विना सिन्धुभिः सप्तमातृभिस् I.34.8.
    Cf. note 32a wherein it is referred to in a limited sense of highlighting the concept of seven motherly rivers.
    b. अयं त्रिः सप्त दुदुहान आशिरं IX.86.21.
    c. त्रिः सप्त सस्रा नद्यो महीरपो वनस्पतीन्पर्वताँ अग्निमूतये X.64.8.
55. इमं मे गङ्गे यमुने सरस्वति शुतुद्रि स्तोमं सचता परुष्ण्या।
    असिक्न्या मरुद्वृधे वितस्तयाऽऽर्जीकीये शृणुह्या सुषोमया
    तृष्टामया प्रथमं यातवे सजूः सुसर्त्वा रसया श्वेत्या त्या।
    त्वं सिन्धो कुभया गोमतीं क्रुमुं मेहत्न्वा सरथं याभिरीयसे X.75.5-6.
56. अयं ते शर्यणावति सुषोमायामधि प्रियः। आर्जीकीये मदिन्तमः VIII.53.11.
    The *Suṣomā* and the *Ārjīka*, together with the *Śaryaṇāvat*, are mentioned in VIII. 7.29. Bhargava identifies them with the Mari (Murree) hills which, according to him, and rightly perhaps, are the origins of the rivers *Suṣomā* and the Ārjīkīyā (Bhargava 1964:24)
57. मा वो रसानितभा कुभा क्रुमुर्मा वः सिन्धुर्नि रीरमत्।
    मा वः परि ष्ठात् सरयुः पुरीषिण्यस्मे इत् सुम्नमस्तु वः V. 53.9.
58. एषो अपश्रितो वलो गोमतीमव तिष्ठति VIII.24.30.
59. VIII.19.37.
60. a. गौरीर्मिमाय सलिलानि तक्षत् I.164.41.
    b. सोमो गौरी अधि श्रितः IX.12.3.
61. Cf. note 59.
62. वधीदिन्द्रो वरशिखस्य शेषोऽभ्यावर्तिनं चायमानाय शिक्षन्।
    वृचीवतो यद्धरियूपीयायां हन् पूर्वे अर्धे भियसापरो II दर्त् त्रिशच्छतं वर्मिणं इन्द्र साकं यव्यावत्यां पुरुहूत श्रवस्या। VI.27. 5-6.
    Also read the verse of 4 for more details of the battle.
63. X.121.4. Cf. note 24.
64. सुषोमे शर्यणावत्यार्जीके पस्त्यावति।VIII.7.29.
    Also see. IX.113.2. and IX. 65.23. And X.35.2. refers to the mountains of the *Śaryaṇāvat*—पर्वताञ्छर्यणावतः
65. In the Avesta, there are mentioned Mount Eregifya (*Ābān-Yast*, 45 and *Zamyād Yast*, I.2) and the 'glowering mountain' *Zarenumant*, which appear closer to *Ārijīka* and *Śaryaṇāvat*, respectively.
66. सोमस्येव मौजवतस्य X.34.1.
67. Atharveda, 5.22. 5, 7, 8 & 14.
68. Cf. note 23.
69. यः परस्या परावतस्तिरो धन्वातिरोचते X.187.2.
70. धन्व च यत् कृन्तत्रं च कतिं स्वित् ता वि योजना। X.86.20.
71. Bhargava 1964:28

(3) धन्वेव ताँ इहि	III.45.1.
(4) अकर्धन्वान्यत्येतवा उ	V.83.10.
(5) जनं न धन्वन्नभिसं यदापः	VI.34.4.
(6) धन्वन्न तृष्णा समरीत	IX.79.3.
(7) स्वस्ति नः पथ्यासु धन्वसु	X.63.15.

72. आर्दन्धन्वानि सरयन्त आपः IV.17.2.
73. त्वया हितमप्यमप्सु भागं धन्वान्वा मृगयसो वि तस्थुः II.38.7.
74. a. धन्वन्निव प्रपा असि त्वमग्न X.4.1.
    b. धन्वचरो V.36.1.
75. धन्वान्यग्नौ अपृणक् तृषाणाँ अधोगिन्द्रः स्तर्यो३ दंसुपत्नीः IV.19.7.

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76. अनु धन्वना यन्ति वृष्टयः V.53.6.
77. a. रायः समुद्रांश्चतुरो अस्मभ्यं सोम विश्वतः IX.33.6.
    b. चतुः समुद्रं धरुणं रयीणाम् X.47.2.
78. उभौ समुद्रावा क्षेति यश्च पूर्व उतापरः X.136.5.
79. a. यच्छक्रासि परावति यदर्वावति वृत्रहन्।
        यद् वा समुद्रे अन्धसोऽवितेदसि VIII.13.15.
    b. ये सोमासः परावति ये अर्वावति सुन्विरे।
        ये वादः शर्यणावति IX.65.22
    c. परावति समुद्रे VIII.12.17.
80. आ समुद्रादवरादा परस्माद् VII.6.7.
81. रयिं च न आ पवस्वा समुद्रात् IX.97.44.
82. नावः समुद्रियः I.25.7.
83. समुद्रे न श्रवस्यवः I.48.3.
84. समुद्रं न संचरणे सनिष्यवः I.56.2; IV.55.6.
85. Several references, a few of are: I.116; I.119; I.182. 5-6; VI. 62.6; VII. 68.7; VII. 69.7; X.65.12, etc.
86. VII. 88.3
87. वि द्वीपानि पापतन् तिष्ठद्.....प्र धन्वान्यैरत VIII.20.4.
88. a. गौराविवेरिणे VIII.76.1.
    b. गौराविवेरिणम् VIII.76.4.
    c. यथा गौरो अपाकृतं तृष्यन्नेत्यवेरिणम् VIII.4.3.
89. प्रवातेजा इरिणे वर्वृतानाः X.34.1.
90. दिव्या अङ्गारा इरिणे न्युप्ताः शीताः सन्तो हृदयं निर्दहन्ति X.34.9.
91. *The Periplus of the Erythraean Sea*, Chapter 40 (p. 38) and section on it (pp. 173-74) by Schoff and also by Ptollemy as in H.C. Geindle's *Ancient India as Described by Ptolemy*, p. 250.
92. अनूपे गोमान् गोभिरक्षाः IX. 107.9.
93. जलप्रायमनूपं स्यात्पुंसि कच्छस्तथाविधः Amarakośam, II.10.
    Cf. Ramakrishna 1990, 69-70.
94. आवदिन्द्रं यमुना तृत्सवश्च प्रात्रं भेदं सर्वताता मुषायत्
    अजासश्च शिग्रवो यक्षवश्च बलिं शीर्षाणि जभ्रुरश्व्यानि VII.18.19.
95. यमुनायामधि V.52.17.
96. X.75.5.
97. अधि बृबुः पणीनां वर्षिष्ठे मूर्धन्नस्थात्। उरु कक्षो न गाङ्ग्यः VI.45.31.
98. Cf. note 62.
99. VIII.24.30.
100. Thapar, (in press)
101. Khan, 1965:11-85; 15-24.
102. Mughal, 1970.
103. Halim, 1972a: 23-89; 1972b: 1-112.
104. Majumdar, 1934.
105. Casal, 1964, 1978.
106. Alcock, 1986:493-551.
107. Wheeler, 1950a:813-816; 1950b:782-783.
108. Alcock, 1986:493-551.
109. Jarrige, 1987:151-203.
110. Vats, 1940.
111. ed. Meadow, 1991.
112. Dales, 1979:241-274.
113. Durrani, 1982:191-207; 1988.
114. Lal, 1975;65-67.
115. Thapar, 1975:19-32.
116. Bisht, 1976; —, 1977; 1978; 1982; 1987.
117. Bisht, 1989:397-408; 1989b: 267-272; 1989c; 1990:71-82; 1993.

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118. Monier-Williams, (1987:635) *pur* is an 'r'-ending feminine word meaning a rampart, wall, stronghold, fortress, castle, city, or town. It is most probably derived from the verb *pṛ* which *inter alia* means 'to protect' occurring in *Dhātupā*, XXV, 4 (Monier-Williams, 1987: 645).
119. II. 35.6
120. V. 19.2; VI. 20.7; VI. 32.3
121. VII. 18.13; VII. 99.5
122. X.101.8
123. IV. 30.20
124. I.58.8; IV.27.1; VII.3.7; VII.95.1; VIII.89.8; X.101.8
125. I. 189.2
126. VII. 15.14; VII.53.1; VIII. 6.23
127. VIII. 6.23
128. I. 166.8; VII. 15.14; It has been a matter of conjecture whether an arm stood for a segment of a wall between two angles or a side of a wall between two bastions. However, in one of the Jātakas the towers or salients are likened to the raised arms of a city wall.
129. VII. 16.10
130. V. 41.12
131. VIII. 69.7
132. VII. 52.1
133. I. 149.3
134. *Nārmiṇī* is of a doubtful interpretation. Monier-Williams (1987:537) mentions it as a name of a town derived from *na* + *armin*, meaning 'not in ruins' but prefers to put a question mark.
135. VIII. 1.28
136. I. 131.4; I. 174.2; VI.20.10
137. I. 174.8
138. I. 103.3; IV.32.10
139. III. 12.6
140. VS
141. AV.18.2.28; YV.2.30.
142. IV. 31.2; V.39.3; V. 86.1; VI. 22.6; VI. 43.3; VIII. 40.1; VIII. 45.13; IX. 34.1
143. पुरः पुरोहा सखिभिः सखीयन् दृळ्हा रुरोज कविभिः कविः सन् VI.32.3.
144. Cf. note 2a.
145. IV. 16.13; VI. 20.7; VI. 73.2; VII. 18.13; VIII. 32.5;
146. I. 109.8; II. 20.7; III. 54.15; VIII. 1.8; VIII. 50.8, and in numerous other verses in all *Maṇḍalas*.
147. I. 130.10; VIII. 87.6
148. VI. 20.3
149. III. 45.2
150. I. 61.5; I. 132.6
151. I. 33.13; I. 174.8; V. 86.1; VIII. 1.8; X. 99.7
152. I. 103.3; VIII. 33.7
153. II. 14.6; VIII. 82.2
154. III. 34.1; III. 51.2; VIII. 33.5; IX. 88.4; X.47.4; X.111.10, etc.
155. I. 11.4
156. I. 112.14, etc..
157. I. 41.3; I.53.7, etc.
158. VI. 32.3
159. I. 51.5; IV. 31.2; IV. 32.10; VI. 16.39; VI. 22.6; VI. 32.3; VIII. 45.13; VIII. 62.18; IX.34.1; IX. 48.2
160. (a) अमित्रान् पुर इष्णासि I.63.2.
    (b) पुरो यदस्य संपिणक् IV.30.13.
    (c) पुरामिन्द्रो व्यास्यत् IV.30.20.
    (d) ऋणोः पुरो वि दुरो अस्य विश्वाः VI.18.5.
    (e) पुरां च्यौत्नायः शयथाय नू चित् VI.18.8.
161. घ्नन् वृत्राणि वि पुरो दर्दरीति जयञ्छत्रूँरमित्रान् पृत्सु साहन् VI.73.2.
162. तन्न प्रत्नं सख्यमस्तु युष्मे इत्था वदद्भिर्वलमङ्गिरोभिः।
    ...मृणोः पुरो वि दुरो अस्य विश्वाः VI.18.5.

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163. पुरं न धृष्णवा रुज कृष्णया बाधितो विशा। VIII.62.18.
164. त्वं पिप्रुं मृगयं शूशुवांसमृजिश्वने वैदथिनाय रन्धीः।
पञ्चाशत् कृष्णा नि वपः सहस्राऽत्कं न पुरो जरिमा वि दर्दः IV.16.13.
165. (a) वि पिप्रोरहिमायस्य दृळ्हाः पुरो वज्रिञ्छवसा न दर्दः। VI.20.7.
(b) त्वं पिप्रोर्नृमणः प्रारुजः पुरः I.51.5.
166. वि सद्यो विश्वा दृंहितान्येषामिन्द्रः पुरः सहसा सप्त दर्दः।
व्यानवस्य तृत्सवे.... VII.18.13.
167. पूरवः पुरो यदिन्द्र शारदीरवातिरः I.131.4.
168. प्र पूरवः स्तवन्त एना यज्ञैः।
सप्त यत्पुरः शर्म शारदीर्दर्द्धन दासीः पुरुकुत्सांय शिक्षन् VI.20.10.
169. दनो विश इन्द्र मृध्रवाचः सप्त यत्पुरः शर्म शारदीर्दर्त्। I.174.2.
170. भिनत् पुरो नवतिमिन्द्र पूरवे दिवोदासाय I.130.7.
171. त्वं पुरो नवतिं दम्भयो नव I.54.6.
172. नवतिं पुरो दासपत्नीरधूनुतम्। III.12.6.
173. शतं पुरो रुरुक्षणिम् IX.48.2.
174. शुष्णं पिप्रुं कुयवं वृत्रमिन्द्र यदावंथीर्वि पुरः शम्बरस्य। I.103.8.
175. (a) दृंहिताः शम्बरस्य नव पुरो नवतिं च श्रथिष्टम् VII.99.5.
(b) शम्बरस्य वि नवतिं नव च देह्योऽ हन् VI.47.2.
176. त्वं शतान्यव शम्बरस्य पुरो जघन्थाप्रतीनि दस्योः। VI.31.4.
177. शतमश्मन्मयीनां पुरामिन्द्रो व्यास्यत्।
दिवोदासाय दाशुषे IV.30.20.
178. अहं पुरो मन्दसानो व्यैरं नव साकं नवतीः शम्बरस्य।
शततमं वेश्यं सर्वताता दिवोदासमतिथिग्वं यदावम् IV.26.3.
179. व्रजं कृणुध्वं स हि वो नृपाणो वर्म सीव्यध्वं बहुला पृथूनि।
पुरः कृणुध्वमायसीरधृष्टा X.101.8.
180. पूश्च पृथ्वी बहुला न उर्वी भवा तोकाय तनयाय शं योः I.189.2.
181. शतं पूर्भियविष्ठ पाह्यंहसः VI.48.8.
182. ताँ अंहसः पिपृहि पर्तृभिष्ट्वं शतं पूर्भिर्यविष्ठय VII.16.10.
183. नपात् पूर्भिरायसीभिः I.58.8.
184. तेभिर्नो अग्ने अमितैर्महोभिः शतं पूर्भिरायसीभिर्नि पाहि VII.3.7.
185. सरस्वती धरुणमायसीपूः। VII.95.1.
186. शतं मा पुर आयसीररक्षन् IV.27.1.
187. शतभुजिभिस्तमभिहुतेरघात् पूर्भी रक्षता मरुतो यमावत। I.166.8.
188. पूर्भवा शतभुजिः VII.15.14.
189. जुहुरे वि चितयन्तोऽनिमिषं नृम्णं पान्ति।
आ दृळ्हां पुरं विविशः V.19.2.
190. अग्ने दीदिहि पुरो नोऽजस्रया सूर्म्या VII.1.3.
191. परि त्वाग्ने पुरं वयं विप्रं सहस्य धीमहि। X.87.22.
192. दिदीहि पुरो विश्वाः सौभगा संजिगीवान्। III.15.4.
193. आ यः पुरं नार्मिणीमदीदेदत्यः I.149.3.
194. पुरो न शुभ्राः V.41.12.
195. मोत जारिषुरस्मत्पुरोत जारि I.139.8.
196. अर्चन्तु पुत्रका उत पुरं न धृष्ण्वर्चत् VIII.58.8.
197. इन्द्र दृह्यस्व पूरसि भद्रा त एति निष्कृतम्। VIII.69.7.
198. आ न इन्द्र महीमिषं पुरं न दर्षि गोमतीम्।
उत प्रजां सुवीर्यम् VIII.6.23.
199. पूर्पीतिं I.173.10.

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200. जनीरिव पतिरेकः समानो नि मामृजे पुर इन्द्रः सु सर्वाः VII.26.3.
201. त्रातोत भवा वरूता। अस्माकासो ये नृतमासो अर्य
इन्द्र सूरयो दधिरे पुरो नः VI.25.7.
202. उपक्षेतिं हितमित्रो न राजा। पुरः सदः शर्मसदो न वीरा
अनवद्या पतिजुष्टेव नारी I.73.3.
203. (a) जनो न पुरि IX.107.10
(b) रण्वः पुरीव जूर्यः VI.2.7.
204. (a) II.11.11.
(b) VIII.3.12.
205. (a) पौरे छन्दयसे हवम् *Vālakhilya* II.5 in the VIIIth *Maṇḍala*
(b) VIII.50.6.
206. पौरं चिद्ध्र्युदप्रुतं पौरं पौराय जिन्वथः V.74.4.
Cf. Valakhilya VI.1. in VIIIth Mandala.
207. पूर्देवत्रा वसवो मर्त्यत्रा VII.52.1.
208. पुर ऋतोः II.28.5.
209. पुरो मही दधिरे देवपुत्रे VII.53.1.
210. दक्षस्य पूर्भिर् V.66.4.
211. Monier-Williams, 1987, 516, col. 2.
212. Ibid., 636, col. 1.
213. Ibid., 634, col. 2.
214. Cf. 179-203
215. I.116.13; – 117.19; –158.2; – 180.6; – 181.9; II.31.4; IV. 26.7; – 27.2; – 27.3 – 34.2; – 50.11; V. 41.6; VI. 21.9; – 49.14; VII. 36.8; – 64.5; VIII. 34.6; IX. 72.4; – 93.4; X. 39.2; – 64.7, etc.
216. VIII. 34.6; X.112.5 and at several other places.
217. I. 123.6; III. 61.1
218. V. 42.5; VI. 21.9; VII. 35.2.
219. X.80.1.
220. cf. 199 and 200.
221. A few examples are: I. 1.1; III.11.1; V.11.2; VIII.27.1; VIII.90.12.
222. Monier-Williams, op. cit, 635, col. 2.
223. Macdonell & Keith, 1912, vol. II :5.
224. *Mahābhārata*, Ādi Parvan.
225. वयं राष्ट्रे जागृयाम पुरोहिताः *Yajurveda*, 9.23.
226. III.3.
227. VIII. 18.15, 17.8 22–25.
228. X. 98.7.
229. I.1.1.
230. cf. 188.
231. अधा मही न आयस्व नाधृष्टो नृपीतये पूर्भवा शतभुजिः VII. 15.14
232. cf.180
233. cf. 190
234. cf. 193
235. cf. 192.
236. VI.48.8.
237. cf.182
238. cf.183
239. cf.184
240. VII. 60.12; –83.4.
241. IX. 101.1.
242. IX. 66.20
243. स नो वाजेष्वविता पुरुवसुः पुरः स्थाता। मघवा वृत्रहा भुवत् VIII. 46.13
244. पुरोळा इत् तुर्वशो यक्षुरासीद् VII.18.6.
245. Cf. 207.
246. For non-Āryan *purs* cf. 143 & 165 (a); and those of the Āryan 189.

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247. Cf. 179.
248. Cf. 179 & 183 – 186
249. Cf. 182.
250. Cf. 187 & 188
251. Cf. 180.
252. Cf. 198.
253. Cf.180.
254. Op. cit.
255. Cf.192.
256. Cf.198.
257. Cf. 198
258. Cf. 193.
259. Cf.194.
260. Cf.197.
261. Cf. 175 (a)
262. Cf. 177
263. Cf.164
264. त्वं पुरं चरिष्णवं वधैः शुष्णस्य सं पिणक् VIII.1.28
265. II. 35.6
266. Cf. 167, 169.
267. Cf. 1b, c, e, & 168.
268. Cf, 1d.
269. Cf. 1c
270. I.174.8.
271. 175 b
272. 175 a
273. 178
274. 1987, 496. col.3.
275. Macdonell and Keith, 1912, Vol. I, 538– 39; Monier-Williams, 1987, 1066, col.1.
276. Monier-Williams, ibid.
277. Sāyaṇa संवत्सरपर्यन्तं प्राकारपरिखादिभिर्दृढीकृताः 'strengthened for a year by walls, ditches and the like'.
278. Wilson, Vol. II, 1977 : 32
279. Ibid : 135
280. Wilson, Vol IV, 1978 : 63. It may, however, be added that no settlement whasoever in *ṚV* is named after an individual king or person.
281. I. 164,11, 12 & 48; X. 114.5 & 6.
282. वेद मासो धृतव्रतो द्वादश प्रजावतः I .25.8.
283. Piggott, 1950 : 165.
284. Shah & Parpola, 1991 : 433, table 1 II a. The table contains squares and rectagles having single and multiple compartments of a large variety. All of them are standard Harappan signs which are used in inscriptions.
285. आपथयो विपथयोऽन्तस्पथा अनुपथाः V.52.10
286. अन्तः शुभ्रावता पथा IX.15.3
287. ज्योतिष्मतः पथो रक्ष धिया कृतान् X.53.6
288. उरुं नृभ्य उरुं गव उरुं रथाय पन्थाम् VIII. 57.13
289. पुरः सदः शर्मसदो न वीरा I.73.3.
290. अच्छिद्रा सूनो सहसो न अद्य
स्तोतृभ्यो मित्रमहः शर्म यच्छ
अग्ने गृणन्तमंहस उरुष्योर्जो नपात् पूर्भिरायसीभिः I.58.8.
291. Monier-Williams, 1058, Col.2.
292. विशे जनाय महि शर्म यच्छतम्। VII. 82.1.
293. शं जनाय शर्मवते। IX.11.3.
294. पाहि नः शर्म वीरवत् IX. 64.18.
295. भवा वरूथं गृणते विभावो भवा मघवन् मघवद्भ्यः शर्मी I.58.9.

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296. (a) पक्षा वयो यथोपरि व्यꣳस्मे शर्म यच्छतानेहसो व ऊतयः सुऊतयो व ऊतयः VIII. 47.2.
(b) व्यꣳस्मे अधि शर्म तत् पक्षा वयो न वन्तन।
विश्वानि विश्ववेदसो वरूथ्या मनामहे VIII.47.3.
297. शर्म यच्छन्तु सप्रथो यदीमहे VIII.18.3.
298. द्युम्नं यच्छन्तु महि शर्म सप्रथः VII. 82.10.
299. बृहत् ते अग्ने महि शर्म भद्रम् V.1.10
300. सुशर्मणो बृहतः शर्मणि स्यामग्नेरहं सुहवस्य प्रणीतौ III. 15.1.
301. स्योना पृथिवि भवानृक्षरा निवेशनी यच्छा नः शर्म सप्रथः I.22.15
302. यद्देवाः शर्म शरणं यद्भद्रं यदनातुरम्
त्रिधातु यद्वरूथ्यं ꣳ तदस्मासु वि यन्तनानेहसो व ऊतयः VIII.47.10.
303. अस्मभ्यं शर्म बहुलं वि यन्त VI.51.5.
304. आदित्यानामवसा नूतनेन सक्षीमहि शर्मणा शंतमेन। VII.51.1
305. अस्मभ्यं धातु शर्म तुभ्यम् X.56.2
306. (a) अच्छिद्रा शर्म जरितः पुरूणि। III.15.5
(b) अच्छिद्रा शर्म यच्छत। न यद् दूराद् वसवो नू चिदन्तितो वरूथमाद्धर्षति। VIII.27.9.
307. शर्म पूषोत नो यमद् वरूथ्यम् V.46.5.
308. Cf.302
309. Monier Williams, op. cit.: 921, col.3.
310. वरूथं तन्वे ३ मम I.23.21 & X.9.7.
311. महि वरूथमूतये II. 34.14.
312. बृहद्भिर्नो वरूथैः IV.56.4.
313. स्याम वरूथे अघ्नतो नृपीतौ VII.20.8.
314. जनेन यातं महि वां वरूथम् VII.53.2.
315. भवा वरूथं मघवन् मघोनां VII.32.7. Also cf. 295.
316. Cf. 306 (b).
317. Monier-Williams, op. cit 922, col.1.
318. (a) शर्म यच्छत्वस्मे क्षयाय त्रिवरूथमंहसः IV.53.6.
(b) शर्मणा नस्त्रिवरूथेन पाहि V.4.8.
(c) स नः शर्म त्रिवरूथं वि यंसत् VIII.42.2.
(d) वसानः शर्म त्रिवरूथमप्सु IX.97.47.
(e) शर्म नो यंसन् त्रिवरूथमंहसः X.66.5 .
(f) ता नः शर्म त्रिवरूथं वि यंसतः X.66.7
Here, the words *yachchhatu, yaṁsan, yaṁsat* and *yaṁsataḥ*, inflected from *yam* which mainly means 'to sustain, hold up, support'; 'to raise, extend or hold (as a screen & c)', are most possibly used in the sense of granting protection. This is further supported by the use of dative *kṣaya*–for habitation–and ablative *aṅhas*–'from or against iniquity'–and also by the use of verb *pāhi* at 'b' above. All these words, in addition to *vasānaḥ* (from √*vas*, to cloth and dress) purporting 'clothed in' 'surrounded' or covered, lend special character to the term *trivarūtha* as a settlement secured by three protecting coverings or ramparts.
319. (a) अधा स्मा नस्त्रिवरूथः शिवो भव VI.15.9
(b) वीरास्त्रिवरूथेन नहुषा शविष्ठ VI.26.7.
320. Cf. 305
321. (a) त्रिधातुना शर्मणा पातमस्मान् VIII.4012.
(b) या वः शर्म शशमानाय सन्ति
त्रिधातूनि दाशुषे यच्छताधि I.85.12.
322. (a) अच्छिद्रं शरणं सजोषा दुराधर्षं गृणते शर्म यंसत् VI.49.7.
(b) तव शर्मन् प्रियतमे दधाना उप स्थेयाम शरणं न वृक्षम् VII.95.5.
323. स त्रिधातु शरणं शर्म यंसत् VII.101.2.
324. Cf.302
325. Monier-Williams, 513, col. 3.

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326. (a) वरूत्रीभिः सुशरणो नो अस्तु त्वष्टा सदत्रो वि दधातु रायः VII.34.22
(b) अस्मान् वरूत्रीः शरणैरवन्तु III.62.3.
327. तवेदिन्द्रावमं वसु त्वं पुष्यसि मध्यमम्
सत्रा विश्वस्य परमस्य राजसि VII.32.16.
328. Monier Williams 1987 : 932, col.3.
329. इन्द्रं परेऽवरे मध्यमास इन्द्रं यान्तोऽवसितास इन्द्रम्।
इन्द्रं क्षियन्त उत युध्यमाना इन्द्रं नरो वाजयन्तो हवन्ते IV.25.8.
330. अवमस्यां पृथिव्यां मध्यमस्यां परमस्यामुत स्थः I.108.9.
331. परमस्यां पृथिव्यां मध्यमस्यामवमस्यामुत स्थः I.108.10.
332. ऊतिरवमा या परमा या मध्यमेन्द्र VI.25.1.
333. धामानि परमाणि यावमा या मध्यमा X.81.5.
334. परमे सधस्थे यद् वावमे वृजने मादयासे I.101.8.
335. यं क्रन्दसी संयती विह्वयेते परेऽवर उभया अमित्राः। II.12.8. Cf. X.88.17; X.120.7.
336. X.17.13.
337. M-W, 1009, col. 1.
338. Cf.note 335 above.
339. Lal, 1979; Thapar, 1975.
340. Joshi, 1990.
341. Bisht, 1989; 91; 93; 94.
342. X.61.14, and numerous other in several *maṇḍalas.*
343. V.45.8., and numerous others in several *maṇḍalas.*
344. यो अस्याध्यक्षः परमे व्योमन् X.129.7.
345. X.59.9.
346. Monier Williams 1987 ; 405, col.2.
347. शर्म वर्म च्छर्दिरस्मभ्यं यंसत् I.114.5.
348. (a) प्र नो यच्छतादवृकं पृथु च्छर्दिः प्र देवि गोमतीरिषः I.48.15.
(b) प्रास्मै यच्छतनवृकं पृथु च्छर्दिर् VIII.9.1.
(c) यन्ता नोऽवृकं छर्दिः VIII.27.4.
also छर्दिर्वत्सायं यच्छतम् VIII.9.15.
छर्दिर्येन दाशुषे यच्छति IV.53.1, and numerous others.
349. (a) छर्दिर्येच्छ वीतहव्याय सप्रथो भरद्वाजाय सप्रथः VI.15.3.
(b) अस्मभ्यं वाजिनीवसू मघवद्भ्यश्च सप्रथः। छर्दिर्यन्तमदाभ्यम् VIII.5.12.
350. अधृष्टं छर्दिर्यद् वां वरूथ्यम् VI.67.2.
351. वरूथमस्ति यच्छर्दि VIII.56.6.
352. त्रिवरूथं मरुतो यन्त नश्छर्दि VIII.18.21
353. VIII.9.11.
354. यच्छत सुप्रवाचनं छर्दिरादित्या सुभरं नृपाय्यम्।
पश्वे तोकाय तनयाय जीवसे X.35.12
355. Cf. note 348 (a).
356. Cf. note 198.
357. 1995: I, 369. Macdonell and Keith have cited the *Ṛgvedic* verses bearing number V.34.7. and VII.25.2 in support of their view. The first cited one, if read only partially (दुर्गे चन ध्रियते) may vindicate the authors. However, if the entire hemistich (दुर्गे चन ध्रियते विश्व आ पुरु जनो यो अस्य तविषीमचुक्रुधत्) is read together, it conveys the meaning that is contrary to the belief as it purports that 'all those people who agigate his (Indra's) anger are placed in difficulty', It may, however, be contended that those people are placed or kept in captivity in a 'stronghold'.
358. नि दुर्ग इन्द्र श्रथिह्यमित्रानभि ये नो मर्तासो अमन्ति। VII.25.2.
The verb *abhi am* (*abhi amanti*) means more appropriately in the sense of inflicting pain, hurting or oppressing than honouring or serving.
359. वि दुर्गा वि द्विषः पुरो घ्नन्ति राजान एषाम्। नयन्ति दुरिता तिरः I.41.3
The two times occurrence of *vi* perhaps indicates that *durgas* are distinguished from *purs* as two different

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entities. There is a weak chance of *durga* being an adjective of *pur*. The use of the word *durga* for a fort had become quite commonplace in the *Mahābhārata* and the later writings.

360. दुर्गे दुरोणे क्रत्वा न यातां पुरु सहस्रा शर्वा नि बर्हीत् IV.28.3
361. वि दुर्गाणि मरुतो नाह रिष्यथ V.54.4.
362. व्रजान् गोमंतो VI.73.3; व्रजं गोमन्तम् VI.10.6; VI.45.24; व्रजस्य साता गोमंतो दधाति VI.10.3; गोमंतो व्रजस्य VI.62.11; गोमतिं व्रजे V.34.5, VII.27.1, VIII.46.9, VIII.59.6, &c.
363. ये पत्वंभिः शफानां व्रजा भुरन्त गोनाम् V.6.7.
364. गवामुरुब्जमभ्यर्षंति व्रजम् IX.77.4.
365. व्रजमा पशुर्गात् II.38.8.
366. अभि व्रजं तत्निषे गव्यमश्व्यम् IX.108.6
367. अश्मानं चिद् ये बिभिदुर्वचोभिः व्रजं गोमन्तमुशिजो वि वव्रुः IV.16.6.
368. अश्मव्रजा IV.1.13; अश्मव्रजानाम् X.139.6
369. VI.1.15; VI.62.11; VII.79.4.
370. व्रजं कृणुध्वं स हि वो नृपाणो X.101.8.
371. व्यू व्रजस्य तमसो द्वारोच्छन्तीरव्रन् IV.51.2; दृळ्हस्य चिद् गोमतो व्रजस्य दुरो वर्तं गृणते चित्रराती VI.62.11.
372. अप व्रजमूर्णथः सप्तास्यम् X.40.8.
373. अहन् दासा वृषभो वस्नयन्तोदव्रजे वर्चिनं शम्बरं च VI.47.21
374. शतव्रजा रिपुणा नावचक्षे। IV.58.5.
375. उदकानि व्रजंत्यस्मिन्निति उदव्रजो देशविशेषः तस्मिन् in the *Sāyaṇabhāṣya* in *Ṛgveda-Saṁhitā*, Chowkhamba Vidyabhawana, Varanasi, 1991: VIth Aṣṭaka, p. 531. Cf also Wilson, Vol VI, 1978, p. 134.
376. Bisht.
377. Macdonell & Keith 1912 : 340
378. *Harivaṁśapurāṇa*, *Viṣṇu-Purāṇa*: 5, 8 & 9 adhyāyas.
379. Ibid., 5. 17–21; 8.17, 22 – 29.
380. Ibid., 5.23 ; 9.21 – 22.
381. Ibid., 9.21
382. Ibid., 5. 24
383. Ibid., 5.27; – – 8.11.
384. Ibid., 8.21.
385. Ibid., 5.24 – 27.
386. Ibid., 5. 19.
387. Ibid., 8.16
388. Ibid., 9.
389. MBH, Āran. 229.1–12.
390. IV.1.13; V.34.5; VI.10.3; VII.27.1; VIII. 46.9; – 59.6; X.101.8.
391. IV.1.15; – 16.6; – 51.2; VI.47.21; – 62.11; – 66.8.; – 73.3.; IX.108.6; X.40.8; – 99.11.
392. IV.1.13.
393. अपावृणोद्दुरो अश्मव्रजानाम् X.139.6.
394. X.101.8.
395. VI.66.8.
396. V.45.1.
397. X.179.2.
398. स्तेन इव व्रजमक्रमुः X.97.10.
399. दृळ्हं चिदरुजो गव्यमूर्वम् III.32.16.
400. (a) विश्वं दृळ्हं भयत एजदस्मात् IV.17.10
(b) दृळ्हान्यौभ्नादुशमान ओजो IV.19.4
(c) सेदुस्त्वया दृळ्हानि सुक्रतो रजांसि VI.30.3
(d) अप दृळ्हानि दर्द्रत् VI.17.5
(e) वि दृळ्हानि चिदद्रिवो जनानां शचीपते। वृह माया अनानत VI.45.9
(f) इन्द्रेण रोचना दिवो दृळ्हानि दृंहितानि च। स्थिराणि न पराणुदे VIII.14.9
401. दृळ्हानि पिप्रोरसुरस्य मायिन इन्द्रो व्यास्यच्चकृवाँ ऋजिश्वना X.138.3

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402. अश्मन्मयानि नहना व्यस्यन् X.67.3
403. दृळ्हमरुजः पर्वतस्य VI.30.5
404. वि दृळ्हस्य दुरो अर्देरौर्णोः VII.79.4
405. स दृळ्हे चिदभि तृणत्ति वाजम् VIII.92.5
406. दृळ्हश्चिद् दृह्य मघवन् मघत्तये VIII.24.10
407. (a) अस्मिन्निन्द्र वृजने सर्ववीराः स्मत् सूरिभिस्तव शर्मन्स्याम I.51.15
(b) अभि ष्याम वृजने सर्ववीराः I.105.19
408. वृजनस्य राजा IX.97.10.
409. वृजनस्य गोपाम् I.91.21; वृजनस्य गोपा I.101.11.
410. वयं राजभिः प्रथमा धनान्यस्माकेन वृजनेना जयेम X.42.10
411. मा नो अज्ञाता वृजना दुराध्योः मा अशिवासो अव क्रमुः VII.32.27
412. देवो न यः सविता सत्यमन्मा क्रत्वा निपाति वृजनानि विश्वा I.73.2.
413. आ यत् ततनन् वृजने जनास I.166.14
414. दुहाना धेनुर्वृजनेषु कारवे त्मना शतिनं पुरुरूपमिषणि II.2.9.
सं विव्य इन्द्रो वृजनं न भूमा भर्ति I.173.6 and cf. note 410
415. सिषक्त्यन्यो वृजनेषु विप्रः VI.68.3.
पिन्वतमिषो वृजनेष्विन्द्र VII.99.6
416. यज्ञेन वर्धत जातवेदसमग्निं यजध्वं हविषा तना गिरा।
समिधानं सुप्रयसं स्वर्णरं द्युक्षं होतारं वृजनेषु धूर्षदम्। II.2.1.
417. Cf. note 334. & यो अवरे वृजने II.24.11
418. Cf. note 411 & अज्ञातेषु वृजनेषु X.27.4
419. न वा उ मां वृजने वारयन्ते X.27.5.
420. Monier Williams, 1007, col. 2.
421. वृजने नदीनाम् V.52.7.
422. I.44.10; – 100.10; – 114. 1; II.12.7; III. 33.11; X.27.19; – 127.5; – 146.1; – 149.4
423. X.62.11; – 107.5.
424. Monier Williams, 373, col. 1.
425. यथा शमसद् द्विपदे चतुष्पदे विश्वं पुष्टं ग्रामे अस्मिन्ननातुरम् I.114.1.
426. यस्याश्वासः प्रदिशि यस्य गावो यस्य ग्रामा यस्य विश्वे रथासः यो अपां नेता स जनास इन्द्रः II.12.7.
427. X.149.4.
428. X.146.
429. X.146.8-6.
430. III.33.11.
431. स ग्रामेभिः सनिता स रथेभिर्विदे विश्वाभिः कृष्टिभिर्न्वद्य। I.100.10.
432. दक्षिणावान् ग्रामणीरग्रमेति X.107.5.
433. X.62.11.
434. *Śat. Br.* V.4.4.18.
435. X.78.6.
436. AV. 10.5.42 & 2.6.4; 3, 8, 2.
437. I.22.4; – 140.12; II 41.2; – 42.3; III.53.6; IV.49.6; V.76.4; VII.18.21; – 89.1; VIII.10.1; – 58.7; X. 18.12; earthen house of death – a grave ; – 91.10; – 165.2; *gṛhapati* VI.53.2; *gṛhapatni* X.85.26.
438. X.99.6. *patir dan* (gen. singh.) ; X.46.7 (*damān*, gen.pl); II.39.2 – *dam–pati*.
439. I.1.8; II.1.8; VI.74.1; IX.111.2; X.91.10;etc.
440. IV.55.2; VII.61.4; VIII.13.20; – 21.4; –41.7; – IX.96.18; – 97.5; X.56.5; – 81.5; – 93.6.
441. I.36.8; – 40.7; IV. 53.7; V.12.6; – 23.4; VII.60.11; VIII.15. 9&13; – 52.7; – 57.12 – 73.8; IX.109.3; X.47.8; – 118.8, etc.
442. V.76.4. VII.5.6; – 56.24; dur + okas = duroka VII.4.3
443. VI.3.3; X.97.5.
444. IV.19.9; VI.71.2; VII.19.5; X.142.7.
445. IV.1. 11& 12; etc.
446. VI. 18.5.
447. VI.62.11.

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448. X. 139.6.
449. VII.79.4.
450. VII.9.2.
451. I.121.4.
452. X.99.3.
453. X.120.8.
454. IV.28.3.
455. VII.7.4.
456. X.37.10.
457. X.120.7.
458. I.108.7; – 117.7; III. 14.3; – 25.4 & 5; VIII.19.27; X.40.13; – 110.1. and several others.
459. V.29.10.
460. VII.4.3.
461. Monier Williams, op. cit., 484, col.2.
462. IV.I.9; – 1.18; – 2.12 and several others.
463. प्रजावतीषु दुर्यासु VII.1.11
464. I.121.1; – 166.4 ; V.32.5; VII.55.6; 56.16; – 76.2; VIII.5.23. IX. 71.4; – 78.3; X. 46.3; – 73.10; – 114.10.
465. Macdonell & Keith, op.cit., vol. II, 499–500.
466. Ibid, Vol. I, 230.
467. I.18.9; – 139.10; VI.51.12; IX. 7.3; X.1.1; – 67.10; – 96.10, etc.
468. I.130.4.etc.
469. V.87.7.
470. VI.51.12.
471. IX. 83.5.
472. X.20.5.
473. III.55.14.
474. दस्मो न सद्मन् नि शिशाति बर्हिः VII.18.11
475. (a) परि सद्मेव पशुमान्ति होता IX.92.6
(b) मितेव सद्म पशुमान्ति होता IX.97.1
476. विश्वे हि त्वा सजोषसो जनासो वृक्तबर्हिषः होतारं सद्मसु प्रियं V.23.3
477. सद्मा होता IV.1.8.
478. IX.83.5.
479. दीर्घं पृथु पप्रथे सद्म पार्थिवं V.87.7.
480. VI.30.2
481. शुक्रसद्मनामुषसामनीके। अयं महान् महता स्कम्भनेनोद् घामस्तभ्नाद् VI.47.5.
482. पुराण्योः सद्मनोः केतुर III.55.2
483. VIII.10.1; – 25.20
484. I.31.15.
485. I.31.17; – 96.7; – 181.5; III.30.9; VII.24.1; VIII.27.5; IX.98.10; X.11.9; –93.5 etc.
486. V.30.11; – 47.7; VIII.9.10.
487. VIII.13.2; – 86.5.
488. X.92.7.
489. X.97.5.
490. IX.71.6.
491. X.135.7.
492. राजानावनभिद्रुहा ध्रुवे सदस्युत्तमे सहस्रस्थूण आसाते II.41.5.
493. त्रीणि राजाना विदथे पुरूणि परि विश्वानि भूषथः सदांसि III.38.6.
494. आपश्चिद्धि स्वयशसः सदःसु देवीरिन्द्रं वरुणं देवता धुः।
कृष्टीरन्यो धारयति प्रविक्ता वृषाण्यन्यो अप्रतीनि हन्ति VII.85.3.
495. रुजा दृळ्हा चिद्रक्षसः सदांसि IX.91.4.
496. माता च यत्र दुहिता च धेनू सबर्दुघे धापयेते समीची। ऋतस्य त सदसीळे अन्तर् III.55.12. Cf. Wilson's translation, op.cit, vol III, 134.
497. वास्तोष्पते शग्मया संसदा ते सक्षीमहि रण्वया गातुमत्या। VII.54.3.
498. अस्य देवस्य संसद्यनीके VII.4.3.

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499. या वृत्रहा परावति सना नवा चुच्युवे।
ता संसत्सु प्र वोचत VIII. 45.25.
500. VIII, 81.20.
501. VI.75.9.
502. Note 49.2.
503. शतदुरस्य X.99.3.
504. सहस्रद्वारं जगमा गृहं तें VII.88.5.
505. क्षत्रम् ..... सहस्रस्थूणं V.62.6.
506. V.45.2.
507. षळस्तभ्ना II.13.10
508. (a) अयो अस्य स्थूणा V.62.7.
(b) हिरण्यरूपम् ..... अयःस्थूणम् V.62.8.
509. समुद्रे अध्याकृते गृहे VIII.10.1
510. भोजस्येदं पुष्करिणीव वेश्म परिष्कृतं देवमानेनं चित्रम् X.107.10.
511. अभ्यारमिदद्रयो निषिक्तं पुष्करे मधुं। अवतस्य विसर्जने VIII.61.11, cf. VI. 16.13.
512. वास्तोष्पतिं त्वष्टारं रराणः V.41.8
513. वास्तोष्पते शग्मया संसदा ते सक्षीमहि रण्वया गातुमत्या। पाहि क्षेम उत योगे वरं नो यूयं पात स्वस्तिभि सदा नः VII.54.3.
514. वास्तोष्पते विश्वा रूपाण्याविशन् VII.55.1.
515. VII.54.1.
516. वास्तोष्पतिं व्रतपां X.61.7.
517. कासीत् प्रमा प्रतिमा किं निदानमाज्यं किमासीत् परिधिः क आसीत्। छन्दः किमासीत् प्रउगं किमुक्थं यद्देवा देवमयजन्त विश्वे X.130.3.
518. Monier-Williams, op. cit., 548, col. 1.
519. उदुस्रियाणामसृजन्निदानम् VI.32.2
520. Monier-Williams, op. cit., 133, col. 2.
521. Ibid., 9, col. 2.
522. Ibid., 596, col.1.
523. I.52.5;—125.7; IX.107.19; X.18.4.
524. Monier-Williams, op. cit., 405, col. 1.
525. Ibid., 172, col.1.

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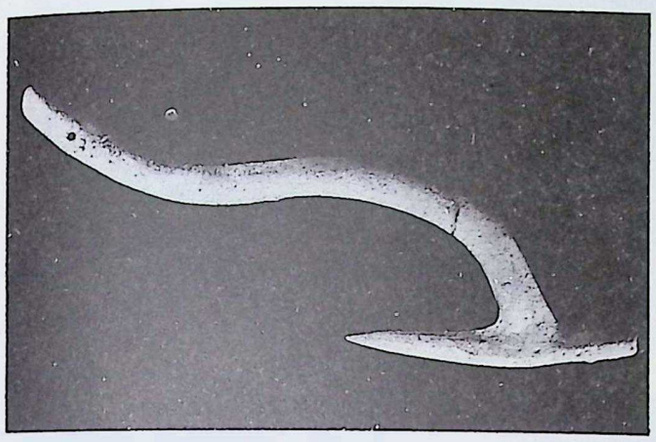

Plate 1: Banawali: terracotta model of a plough, Harappan period.

Plate 2: Banawali: mother and child terracotta, Harappan period.

Plate 3: Dholavira: arterial street running across the middle town.

Plate 4: Banawali: a Harappan well in the lower town.

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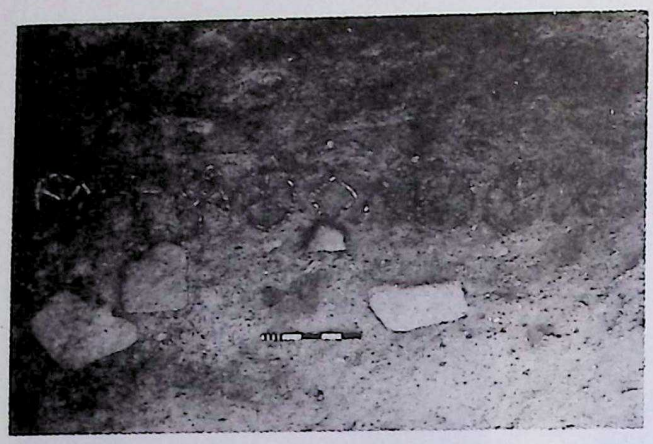

Plate 5: Dholavira: the inscription of the Harappan period lying *in situ* in the western chamber of the north gate of the castle in the citadel.

Plate 6: Dholavira: the east gate of the castle in the citadel.

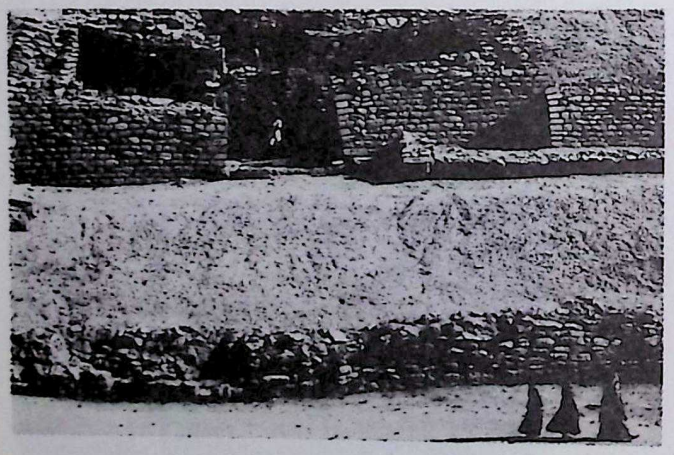

Plate 7: Dholavira: the north gate of the castle in the citadel.

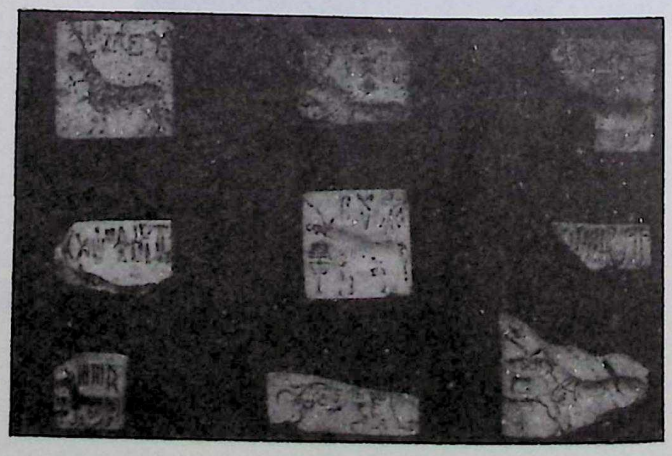

Plate 8: Dholavira: seals of the Harappan period (Stage IV-V).

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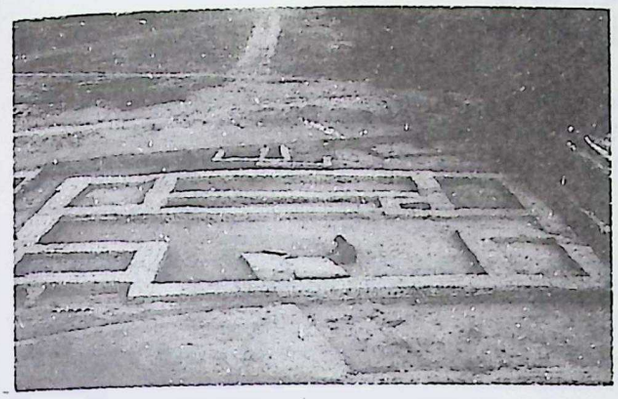

Plate 9: Banawali: house complex of the intermidiate phase (period IC).

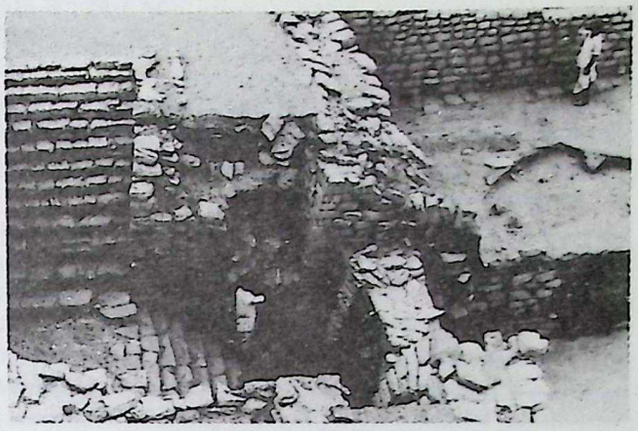

Plate 10: Dholavira: 'L'-shaped staircase leading into the castle in the citadel.

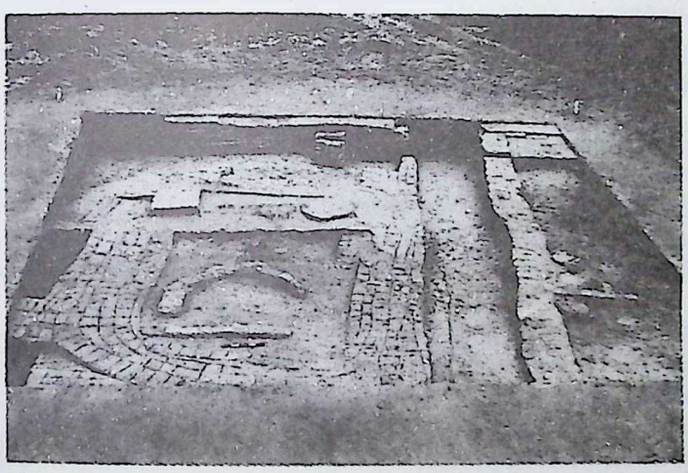

Plate 11: Banawali: An apsidal structure of the Harappan period (period II)

Plate 12: Banawali: streets, residential sectors near the east gate of the lower town, Harappan period (period II).

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CHAPTER XIV

Decline, Last Phase and Legacy of Indus Civilization

B.B. Lal

Anything like the mighty civilization that dominated the northern parts of the Indo-Pakistan subcontinent in the second half of the third millennium before Christ was not to be witnessed again on the subcontinent until the middle of the first millennium BC, when another great civilization came into being, the focus, however, having shifted from the Indus in the west to the Gaṅgā in the east. This latter civilization saw a long continuity and may be regarded as a major contributor towards the make-up of what subsequently came to be recognized as the mainstream of the Indian civilization. But did the Indus Civilization leave no legacy? And if it did, as it seems to have done, what was the nature of this legacy? To understand this legacy, it would be necessary to go into the probable causes of the decline of the Indus Civilization itself.

Scholars have adduced various reasons for the end of the Indus Civilization, such as external invasions, massive flooding, catastrophic climatic changes, wearing out of the landscape through over-use, rendering it less and less productive, and so on. While some of these did no doubt have their share in the fall, to the present author there seems to be yet another factor which needs to be emphasized. Elsewhere (Lal, 1992), the author has stressed that a spurt in trade, both internal as well as external, was a major contributor towards the rise of the Indus Civilization. Here he is inclined to suggest that a fall in and subsequent snapping of, this trade may have been a major factor in the decline and ultimate fall of this civilization, though no doubt there were other ancillary causes as well. Just as in a matter of a century or so, around the middle of the third millennium BC, there was an explosion of Indus trade with Mesopotamia, the Persian Gulf, etc., including the setting up of a trading colony as far north as Shortugai in Afghanistan, and an almost simultaneous setting up of the great urban centres on the subcontinent itself, a fall in this trade around the end of that millennium synchronized with the decline of the big cities which disintegrated within a mater of a couple of centuries at the most. While we shall go in some detail into this fall in trade vis-a-vis the urban decline a little later, it may be well worth while to discuss, though briefly, some of the more dramatic causes that have been advanced for the end of the Indus Civilization.

On circumstantial evidence Indra stands 'accused', declared Wheeler in the report on his 1946 excavations at Harappa (Wheeler, 1947; 82). To Wheeler must go the credit of excavating the fortification wall around one of the mounds (Mound AB) at Harappa. (The possibility of the existence of such a wall, however, had been mooted earlier also.) This discovery when looked at against the backdrop of the Vedic literature, wherein it is mentioned that Indra, the favourite Aryan god, was the destroyer of forts (*puraṁdara*), made Wheeler think that it was the Aryan invaders who were responsible for the end of the Indus Civilization.

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The mention, again, in the Vedic literature of a place by name Hariūpīyā added fuel to the fire, for it was most tempting to identify, on the basis of sound-philology (which unfortunately is not always sound), the Vedic place-name with modern Harappa. To strengthen his theory of the Aryan invasion, Wheeler cited the skeletal remains in the upper levels of Mohenjodaro, holding that the dead had been massacred by the invading Aryan hordes.

Enough has been written on this 'mythical massacre' at Mohenjodaro to demonstrate the fallacy of Wheeler's assumption (e.g. Dales, 1964). To recapitulate very briefly, all the skeletons do not belong to one and the same stratum, nor do these strata mark the end of the site. Further, by and large, the skeletons show very little evidence of physical injury—an evidence legitimately expected in the case of mass murder. In a few cases no doubt there existed cranial cuts, but these had been partially healed, indicating that there was a time-lag between the wounding and the death, which would not have been the case had the persons concerned been massacred in an invasion. Even on another ground it would be wrong to invoke any foreign invasion, much less that of the Aryans, since no traces of any alien material expected to be left by the invaders is available in the levels where the skeletons have been found, nor even in the subsequent levels. The Jhukar element found in the upper levels of the site was not 'foreign', but belonged to the devolutionary stage, to which we shall refer a little later.

Another theory (Raikes, 1964 and 1965) has it that there was a great tectonic uplift upstream of the Indus delta, in the neighbourhood of Sehwan, resulting in the formation of a huge lake which engulfed Mohenjodaro and other sites and in the sequel brought about the end of the Indus Civilization. To strengthen his argument, Raikes quoted the recent (1819) uplift of a similar area, known as Allah Bund. This theory has successfully been refuted by Lambrick (1967) and Possehl (1967) and one need not go into the various arguments all over again. While there is no doubt about the raising of the mud-brick platforms in the Citadel area at Mohenjodaro, this may have been due partly to some flooding but perhaps equally to the very concept under which the buildings in the Citadel at Mohenjodaro had been laid out, namely their placement on deliberately constructed platforms. Thus, as and when necessary, these platforms had to be renewed and raised. However, this is a feature not exclusive to Mohenjodaro, but is available at Kalibangan also where there is evidence of the raising of the platforms, but none whatsoever of any kind of flooding. In any case, just the flooding of a few individual settlements like Mohenjodaro cannot and ought not to be regarded as having brought about the end of a civilization. Jhukar, Amri and Chanhudaro, all located in the same lower Indus valley, continued to exist. And it is such sites as these that throw valuable light on what ultimately happened to the once mighty Indus Civilization; namely, a devolution and not an abrupt end through a foreign invasion or a catastrophic flood. Also, as would be shown later, this devolution in its rate and configuration varied from region to region, depending on a number of local factors.

We have just referred to Jhukar, Amri and Chanhudaro as examples demonstrating the devolution of the Indus Civilization. Way back, in 1928, N.G. Majumdar identified at Jhukar a pottery which was in certain ways different from the Mature Harappan Pottery. Thus, while the latter was a sturdy red ware, often with a red slip and designs painted in black pigment, in the case of the former there was an additional use of red/brown colour and quite often of a slip that varied from white to a shade of buff. The Jhukar painted designs too were not so crisp, well-set and varied as in the case of the Mature Harappan and included such features as loops along the rim, circles with red dots, elongated lozenges, thickly outlined leaves, multiple zig-zag lines, etc. As happens with most discoveries, much was made of a somewhat different pottery-style, and Mackay, who excavated Chanhudaro and Piggott, who wrote the first ever all-inclusive account of protohistoric India, overemphasized this single culture-constituent and treated the Jhukar pottery as signifying an altogether different culture, called

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Jhukar Culture, with a break between it and the Harappan (Mackay, 1943; Piggott, 1950). That this indeed may not have been the case was often mooted, but has now been categorically established by fresh excavations at Jhukar itself by M.R. Mughal (1992).

At this site, below the early historical levels, with a break between them and the preceding ones, Mughal encountered a continuous occupation which he divided into three phases. (The natural soil was not reached because of the high water-table.) In all the three phases Mature Harappan pottery and other associated artefacts were met with, though there was a decrease in them as one came up. However, more important is the fact that the characteristic Jhukar style pottery occurred in the uppermost phase and did not account for more than 8 percent of the total pottery assemblage (Mughal, 1992, 215). It is, thus, absolutely clear that; (*i*) there was an occupational and cultural continuity from the Mature Harappan times to those when the Jhukar-style pottery made its appearance, and (*ii*) there is hardly any justifiable case for treating the so-called Jhukar Culture as an entity quite separate from and having nothing to do with the Mature Harappan. No pottery-styles or for that matter styles in other artefacts are eternal. They do undergo changes. Continuity coupled with change, whether involving evolution or devolution is one thing, whereas discontinuity followed by subsequent appearance of an altogether alien outfit is another. The Jhukar Culture falls in the former category.

Since Mughal's paper (1992) is devoted to the late Harappan cultural mosaic in general, he has not given in it details of how the other culture-constituents, such as seals, weights, etc. behaved through his three successive phases. Anyway, a better picture of these can be had from what happened at Amri and Chanhudaro.

It was N.G. Majumdar, way back in 1929, who did trial-trenching at Amri and brought to light a class of pottery after which the material complex has been named as the Amri Culture (Majumdar, 1934). However, Majumdar's work was only of an exploratory kind and it was J.M. Casal's excavation, from 1959 to 1962, that gave a clearer picture not only of the Amri culture but also of what transpired at the site from its beginning to the end (Casal, 1964).

At present there are two mounds at the site, named A and B, though originally these seem to have constituted a single unit. Anyway, a combined stratigraphy from the two mounds shows the following sequence of cultures. From bottom upwards, Period I, with its four subdivisions, viz. A, B, C and D, is purely Amrian. The various subdivisions show an evolution in the pottery-styles, which also reveal some links with Baluchistan, Afghanistan and south-eastern Iran. On the basis of Carbon-14 dates, the beginning of the Amri Culture seems to be assignable to around the middle of the fourth millennium BC.

Period II has been called an 'Intermediate' one in which the elements of the Amri Culture continue, but those of the Harappa Culture also manifest themselves.

With the beginning of Period III, there is full manifestation of the Harappa Culture and the Amri pottery disappears. Within Period III, the excavator has made four subdivisions, viz. A, B, C and D. Not being a metropolitan town or a trading station, the site is not rich in certain classes of antiquities, such as seals, sealings, weights, etc. Only a few examples of these have been discovered. However, it has yielded very useful evidence in regard to the pottery which shows a gradual change (or devolution if one likes to use that term) from one period to the following. Thus, for example, in the case of the dish-on-stand, the stand part was usually squattish in Subperiod III A, while in III B there were more examples of a longish stand. In III C, in the upper part of the elongated stand there is a bulbous protuberance. Likewise, there was a change in the rim-parts of the basins and bowls; whereas in III A it was nail-headed, in III B it became slightly averted; in III C and III D it got projected outwards and even became flattish. Surface-treatment as well as the painted designs also kept on gradually changing. For example, besides the usual black-on-red ware continuing from III A, III C yielded: (*i*) a light-brown chocolate ware with designs in black or violet-black, and (*ii*) a pinkish or purplish blue ware with black or violet designs. Even the designs showed a change, both in their execution

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as well as subject-matter, Thus, for example, from III C onwards the outlines were heavier, indicating the use of a thicker brush. The new designs included a series of internally striped ovals, barbed circles with a central dot, etc. In III C, the design of a small tree bearing big leaves with hatched filling and thick outline becomes more conspicuous. The latter designs and even the surface-treatment referred to earlier are typical of what has been designated as the Jhukar Culture. To Subperiod III D is also ascribable a stone seal characteristic of the Jhukar Culture. Here again, then, is a case of gradual transformation from the Mature Harappan stage to an impoverished Jhukar one. To quote the excavator himself: 'We hope to have thus typologically justified our belief that the so-called Jhukar Culture, which cannot do anything at Amri but to follow Period III C, does really belong to the same process of evolution and degeneration as the Harappan Period exemplified by Period III A.' (Casal, 1964; Summary in English. p. 13.)

Chanhudaro, opposite Amri, on the eastern side of the Indus has a similar evolutionary story to tell. Explored and partially excavated by N.G. Majumdar in 1929 (Majumdar, 1934), it was subjected to detailed operation during 1935-36 by E.J.H. Mackay (1943). However, due to the high water-table the lowest occupational levels were not reached and hence one cannot say if any Amri-like material existed there or not. Thus, the earliest identified levels were those of the Harappa Culture. Of the Harappan occupation, three distinct structural strata were identified, with a deposit of silt and debris in between them. These were numbered by Mackay as I, II and III, from top downwards. While discussing the layout of the settlement and structures. Mackay states: 'The arrangement of these streets [referring to the streets of Period II] shows that some attention had been paid to town-planning, a feature which we did not find in the Harappa I level above. Nor did we find any drainage system of importance in the latter stratum. A very considerable decline in the amenities of life had evidently taken place in the interval between the two periods. This decline was also noted in the uppermost strata of Mohenjodaro.' (Mackay, 1943; reprinted 1976; 39)

Period II seems to have been the most affluent, for herein was found the evidence of the manufacturing of a number of commodities meant for trade, both internal as well as external. For example, the presence of beads in various stages of preparation as well as of drills and lumps of raw material leaves no doubt about their mass production. Likewise, the occurrence of unfinished weights, of course along with finished ones, points towards their local manufacture. Since weights are highly specific objects and require perfect standardization, it may well be that Chanhudaro supplied them to many other Harappan settlements, though there may have been a few other centres of this kind. Evidence also indicates that Chanhudaro was making seals as well; of these, as many as eight unfinished examples were found in one area, shell-working may have been still another craft of this settlement. But corroborating the aforesaid evidence of general decline in the town-planning, structures and drainage system in Period I, these various crafts were also on the wane in that period. Thus, for example, in the list of antiquities coming from Period II of Mound II Mackay (ibid.: 53-58) mentions 15 seals, whereas only one comes from Period I (pp. 34-6). A similar fall may be noted in respect of the weights. The overall picture, thus, is of a decline from Period II to Period I.

Period I presents yet another aspect of this story. In it, along with the typically Harappan objects, had been found many which belong to the Jhukar Culture, thought to be alien by Mackay (pp. 27-34). However, a closer study of the data given by Mackay himself indicates that whereas there were silt and debris deposits between Periods II and III and again between Periods II and I, although all the three belonged to the Harappa Culture, there was no such intervening deposit between Period I and what has been termed as the Jhukar occupation. In fact, Mackay himself states that the so-called Jhukarians used the houses of Period I. Thus, there seems to be, prima facie, a case for a transition, in Period I, from the Harappan assemblage to that known as Jhukar, rather than the latter being an altogether alien culture imported from elsewhere. However, to clear up the mess, it would perhaps be well worth while

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to carry out fresh excavations at the site, on the basis of soil-stratigraphy, since the one by Mackay, as is well known, was done on the basis of bench-levels.

From the foregoing analysis of the data from Mohenjodaro, Jhukar, Amri and Chanhudaro it would be seen that the Indus Civilization was not found dead one fine morning but that in the Sindh region it devolved gradually and got transformed into what is known as the Jhukar Culture.

Moving northwards into the plains of the middle-Indus and its tributaries, one comes to the site of Harappa. Vats's excavations over here brought to light the remains of the Mature Indus Civilization as well as those of what he called the Cemetery after the burials encountered in an area designated as 'H'. Of these burials, two strata were identified: an earlier one (called Stratum II) with extended burials and a later one (called Stratum I) with fractional interment inside large pots. The concomitant material in both strata, however, was almost the same. Pottery similar to that from Cemetery H burials had also been found on Mounds AB and F and Area G, pointing to the corresponding habitations deposits.

The exact relationship of Cemetery H with the Mature Harappa Culture, however, has long been a matter of debate. The Cemetery H pottery is characterized by a bright red slip and bears paintings in jet black pigment. The designs, singly or in combination, have their own identity and cannot be confused with those on the Mature Indus pottery. Besides, the section-drawing published by Wheeler (1947; Pl. XXXIX) of his trench linking the Harappan Cemetery (R-37) with Stratum I of Cemetery H shows that a massive debris layer intervened between the two, pointing ipso facto to a time-lag. Wheeler, following Gordon Childe (1934;223), was inclined to think that the Cemetery H people may represent the Aryan invaders who destroyed the Indus Civilization (Wheeler 1947; 81-82).

However, fresh excavations at Harappa by Dales and Kenoyer seem to suggest a different story. Organizing the stratigraphy of Mound E, which had remained almost untouched previously and where their main work lies, the excavators have worked out five periods from bottom upwards. Their Periods 1 and 2 relate to Early Harappan Culture, there also being a manifestation of transition from the Early Harappan towards Mature Harappan in the upper levels of Period 2. Period 3 is typically Harappan. Period 4 again shows elements of transition, this time towards the Cemetery H Culture which is fully manifested in Period 5 (Kenoyer 1991). He adds: 'On the basis of ceramic styles and morphology, some of the latest burials of the recent cemetery [R-37] excavations as well as some of the early burials in Cemetery—excavations by Vats (1940) may be associated with Period 4.' (Kenoyer, ibid.: 18)

Referring to period 5, Kenoyer states:

> These strata contain Cemetery H ceramics and have drains and baked bricks of a size smaller than that of Period 3 occupation.... Period 5 may reflect only a change in the focus of settlement organization from that which was the pattern of the earlier Harappan phase and not cultural discontinuity, urban decay, invading aliens, or site abandonment, all of which have been suggested in the past.' (Ibid.: 18)

In this context it may be well worth while recalling that, while discussing Periods 1 and 2, Kenoyer has stated: 'The transition between the two Periods appears gradual, but since the analysis is not yet complete, such statements must be understood as being provisional' (Ibid.: 8). Perhaps the same provisionality seems to attach to the relationship between Periods 3, 4 and 5. We await a fuller publication of the relevant data since these are of fundamental importance in understanding what happened after the Mature Indus phase in Pakistani Punjab and adjacent areas. It would be appropriate if the evidence from Harappa is cross-checked from other sites as well in the region.

Cholistan, in the former Bahawalpur State of Pakistan, has been thoroughly explored by Mughal (1990). Now a desert, it used to be watered by the (now-dry) Hakra, which further up,

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in northern Rajasthan (India), is known as the Ghaggar on whose bank the well-known Harappan site of Kalibangan is located. In Cholistan, Mughal came across 99 sites associated with a ware called by him as the 'Hakra Ware'. Representing the earliest settlement in the region. In succession, there were 40 sites of the Early Harappan Culture, 174 of the Mature Harappan, 50 of Late Harappan and 14 of the Painted Grey Ware.

Mughal's 'Late Harappan' sites are all characterized by the Cemetery H Ware, However, one thing needs to be noted, namely that Mughal did not carry out any excavation and thus it is difficult to know whether or not there was a regular transition from the Mature Harappan phase to that of Cemetery H. It is only to be hoped that one day Mughal will find an opportunity to do the same, since as I said earlier, the lonely evidence of Kenoyer for such a transition at Harappa needs to be confirmed by other sites.

Giving a statistical break-up of his *50 Late Harappan Sites*, Mughal adds 'that 46.1% of the total late Harappan sites are less than 5 ha. in size and nearly 27% come within the range of 5 to 10 ha. Four sites cover an area of 15 to 20 ha., while the site of Kudwala, near Yazman, covering 31.1 ha, is the largest settlement of the Late Harappan period. It is evident that some population had concentrated at four settlements of up to 20 ha. in size and at two sites of 10 to 15 ha., but all were dominated by the large urban centre of Kudwala.' One wishes Mughal takes up this site for the above-suggested excavation, since one would like to know what kind of 'urbanism' still continued in the Late Harappan (Cemetery H) times. Did the people continue with town-planning and have monumental buildings? Did they use seals and sealing and weights and measures? And does the site yield any evidence of long-distance trade? Anyway, the size of Kudwala, viz. 311 ha., is far less than that of the Mature Harappan settlement in the same region, viz. Ganweriwala, which, according to Mughal's own data, was 85.5. ha. in extent. prima facie, a decline seems to have set in.

As we proceed eastwards along the Hakra-Ghaggar system, we enter north-eastern Rajasthan. Here the prolonged excavations at Kalibangan did not give any inkling of a post-Mature Harappan period. Though no doubt the occupational area in the upper levels was found to have shrunk as compared to the overall area of the site, this seems to be due to the erosion of the upper levels of the mound during the past four thousand years. It may also be noted that even in the latest phase the lay-out of the streets was not meddled with, nor did such antiquities as seals and sealings disappear. Kalibangan, thus, met its death as an adult and did not witness an incapacitated old age. The reason for the abandonment of Kalibangan, and like it of the other sites in the region, seems to lie in the drying up of the Ghaggar river which was the main, or perhaps the only, source of water-supply. The wells found inside the houses could not, in any case, have provided water for agricultural activities.

In north-eastern Rajasthan, Haryana and Punjab there is ample evidence to show that a series of small to sizeable rivers joined the Ghaggar system. Many of these are now dry, but a few are still flowing. The Mature Harappans had already occupied the banks of some of these rivers, establishing such sites as Banawali, Rakhigarhi, Balu, etc. Since in these upper regions water-supply was not so much of a problem as in the middle Ghaggar valley, it is in these regions that we find a good deal of evidence relating to the post-Mature Harappan phase.

To the north of the Ghaggar system there are the Sutluj, Ravi and Chenab. The Harappans seem to have made use of these river-courses as well, and this would account for sites like Kotla Nihang, Rupnagar (formerly called Ropar) and Bara along the Sutluj and Manda along the Chenab. At a somewhat later stage the Late Harappans crossed into the upper Gaṅgā-Yamunā Doab, presumably along the piedmont area and broke new grounds by establishing sites like Bargaon, Alamgirpur, etc. J.P. Joshi and his colleagues (1984) have listed over 500 sites assignable to the various stages of the post-Mature Harappan scenario in these regions, covering roughly a major portion of the second millennium BC. While it is difficult

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to deal with the data yielded by all these sites, an attempt will be made to analyse and synthesize the more important pieces of evidence.

However, before that is attempted, it may perhaps be worth while to make a statement regarding what I mean by the term Late Harappan, since it has often been used rather loosely or in different senses by different scholars. To me Late Harappan would mean a culture-complex which has transformed itself from the Mature Harappan, losing some of the latter's traits and evolving some new ones, but still identifiable as having been derived from the latter. To put it differently, it may be likened to one Mr. X in his old age, whose hair may have grown grey, skin shrivelled, limbs may have lost muscularity and who may even be walking bent with the help of a stick, yet anybody who had seen him in his youth should be able to recognize him (maybe with some initial hitch) as the same Mr. X. But once the culture-complex gets diluted beyond recognition, it may not be advisable to use the term Late Harappan for it. For example (just to anticipate what would be discussed in some detail later), while the culture-complex met with in Banawali Period II is Mature Harappan all right and that of Alamgirpur Period I may be regarded as Late Harappan, the culture amalgam at Dher Majra, wherein not only is the pottery not recognizable as Harappan but also even amongst the antiquities none is characteristically Harappan, loses the right to be designated as Late Harappan. We do have to draw a line somewhere.

In trying to work out what happened in Haryana and Punjab after the Mature Harappan it is necessary to have an idea of what was there in these regions prior to and contemporary with the Harappan. In the present state of our knowledge two trends seem to have existed, namely one of the pre-Harappan Kalibangan type, particularly in the Ghaggar system, and the other of a complex known as the Baran from the type-site Bara on the Sutluj. These complexes are to be seen independently at some sites, along with the Mature Harappan at some others and again in the post-Mature Harappan stage sometimes even with a dominating share in the complex. At some of the sites elements of Cemetery H also show up, though in a feeble way. This may perhaps be explained by some kind of contact with the Bahawalpur region in post-Mature Harappan context.

A somewhat detailed picture of a few selected sites may now be presented to substantiate the aforesaid general remarks.

Roughly 125 km to the east of Kalibangan, on the bank of a now-dry river of the Ghaggar system, lies Banawali in District Hissar of Haryana. The excavations carried out here by Bisht (1987; this includes previous references as well) brought to light three occupational periods. From bottom upwards, Period I was characterized by a culture-complex similar to that of Period I at Kalibangan. However, in the upper levels of this Period certain features had started manifesting themselves which were to be characteristic of the subsequent Period II, for example triangular terracotta cakes, chert blades and bricks having a ratio of 1:2:4. Without any break, there was Period II which, while incorporating the material of Period I, showed the Harappa Culture in its full maturity-sealings, weights, measures etc., and an Acropolis and a Lower Town, both within an overall fortification wall, though the former was separated from the latter by a partition wall.

However, as regards Period III, the excavator states: 'After the desertion of the site by the Harappans for unknown reasons there followed the time of break before the impoverished post-Harappans entered the stage. The newcomers settled down in the east, under the very shadow of, but outside, the fort-town of their predecessors.' (Bisht 1987:151). Within an average deposit of a little over half a metre assignable to this Period three building phases were noted. In Phase 2 an over 30-metre long outer wall of a house was encountered along with a few rooms on the inner side. It was made of clay, there being no evidence of even mudbricks, not to speak of kiln-fired ones. However, in this and other houses there was evidence variously of clay-bins, storage pits, fireplaces and *tandūrs*. The storage pits were

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circular on plan, had tapering or straight sides and a flat bottom, the entire interior being plastered.

As regards the pottery of Period III. Bisht says: 'Curiously all classical Indus shapes and painted motifs are conspicuous by their absence. Conversely, most shapes prevalent during Period I at Banawali and other identical sites are present during Period III at Banawali but with slight or pronounced modification.' (Bisht ibid.: 152). Made of well-levigated clay and well fired, the pottery had a glossy red slip. The shapes included, besides the usual dish-on-stand so common to most of the pre-Harappan, Harappan and post-Harappan complexes, cooking vessels, baking plates, dough plates, etc. No detailed drawings of this pottery are available for analysis. Thus one can do no better than to quote the excavator once again: 'By and large this pottery has shown strong genetic relationship with two different ceramics, i.e. the Kalibangan [Period 1] pottery and Bara pottery.' (Bisht ibid.: 152.)

Period III was poor in antiquities. In any case, none of the characteristic ones of the Mature Indus Civilization, such as seals, sealings, weights, measures, cherts blades, etched carnelian beads, etc., were found. Some small pieces of terracotta or baked clay are, however, reminiscent of the Indus triangular 'terracotta cakes'. Noteworthy, however, was an unidentified terracotta object. It has a square base with pronounced cavities on all sides. It has a concave body which finally terminates into projections looking like snake-hoods. Because of its discovery in a pit which also contained a *liṅgam*-like terracotta, the former piece is also thought to have been a cult object, Additional significance attaches to this object since more or less similar pieces have been found at sites like Bara, Hulas etc.

In sum, Banawali does not give us the story of the devolution of the Mature Harappa Culture itself. Instead it presents to us a *fait accompli*—a culture distanced from the Mature Harappan both in time and contents. Qualitatively, it had no urban insignia.

However, Balu, a site about 90 km east of Banawali and located on the bank of the Chautang, a now-dry river of the Ghaggar system, yielded a sequence which shows a transition from the Mature Harappan stage to the Late Harappan, as does Mitathal, about 70 km to its south. While Balu A is comparable to Kalibangan I and Balu B to Kalibangan II, Balu C is Post-Kalibangan II, showing a continuation to a later stage. There were changes in the pottery-types, but the sizes of bricks used in Balu C were the same as in Balu B. Burnt-brick drains were also noted in Phase C, showing that civic standards had not yet completely disappeared. (Singh and Bhan, 1982.)

A small-scale excavation at Mitathal, located in the south-eastern region of Haryana, has yield two periods of occupation (Bhan, 1975). Period I has yielded material similar to that of Kalibangan Period I; even the brick-size in the ratio of 1:2:3 is repeated. Period II has been divided into A and B. In Period II A, not only do the elements of Period I continue but those of typically Harappa Culture are also present, including bricks in the ratio of 1:2:4. There is also evidence of some sort of town-planning, with streets/lanes oriented north-south and east-west. From II A to II B is a transition with no break. There was, however, a general deterioration in the cultural equipment. Some of the pottery shapes show a clear change—devolution or evolution as one may like to call it. For example, the dish comprising the upper part of the dish-on-stand now has a pronouncedly drooping rim. Some of the vases have a long neck gradually flaring out and ending up in a wide mouth with an everted rim. Also to be noted is a bowl-shaped lid with a central knob. These are some of the types which may be regarded as characteristic of the Late Harappan in this region. With these also go pots bearing a variety of incised designs on the exterior.

Moving north-eastwards in the overall Ghaggar system, one may note the culture-sequence at Bhagwanpura. It carries the story beyond the Late Harappan stage, to a point of overlap between an amalgam of various trends derivable through a long process of devolution from the Harappan, Baran and Kalibangan I cultures on the one hand, and the Painted Grey

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Ware Culture on the other. This overlap may have taken place some time in the last quarter of the second millennium BC.

Located on the right bank of the Sarasvatī in District Kurukshetra, Haryana, Bhagwanpura was excavated by J.P. Joshi (1978). Within an occupational deposit of 2.5 m in thickness, he identified two subperiods, called I A and I B. Assignable to I A, which was Late Harappan in character, there was a large mud-platform presumably put up to protect the habitation from the floods of the Sarasvatī. The dominant pottery was a red ware, plain and painted, the most distinctive forms being dishes-on-stand with drooping rims of the dishes, jars with long splayed-out neck and everted rim, thin flasks, button-based goblets and cups, etc. Amongst the painted designs, which included geometric and vegetal motifs, one may mention the pipal and banana leaves so common on the Harappan Ware. Joshi also mentions, 'thick Grey Ware, generally associated with Harappan and Late Harappan assemblage,' as well as Baran pottery. The suggested Cemetery H affiliation of some pottery may be only superficial, since the typical Cemetery H forms and painted designs have not been reported.

Subperiod I B witnessed a dilution of the Late Harappan pottery along with which there occurred first plain grey ware and then the typical Painted Grey Ware. Within this subperiod three structural phases were noted. In the earliest were found round and semi-circular thatched huts. To the next belonged a large 13-room mud house in which were found plain grey and Painted Grey Ware vessels along with a small (two to five) percentage of pottery derived from the late Harappan repertoire. In the latest phase were encountered the remains of structures made of kiln-fired bricks whose sizes were quite different from those of the Harappan, such as 12 × 12 × 8 cm, 16 × 12 × 4, etc. Amongst the antiquities, mention may be made of an incised terracotta ram of Harappan derivation and of a violin-shaped 'Mother Goddess' in grey ware, the latter of which continues into the early historical in the Gaṅgā valley. The kind of overlap witnessed at Bhagwanpura has been noted by Joshi at Dadheri, Kathpalon and Nagar, all in Punjab. It also needs to be noted that at none of these four sites was iron met with in the overlap period, though copper objects were duly found.

In the context of the aforesaid overlap one may also refer to Sanghol, excavated first by Bisht and then by G.B. Sharma. According to the latter, the protohistoric occupation of the site is divisible into three Sub-periods, viz. IA, IB and IC. Of these, IA yielded the Bara Ware without structures; IB had the Bara ware along with structures; and IC gave evidence of an overlap between the Bara and the Painted Grey Ware (Y.D. Sharma, 1982; 157).

In the preceding pages we have referred to Bara pottery/Bara Culture without giving even a summary of the excavations at the site. This was due to the fact that until now we were dealing with sites primarily in the Ghaggar system, making only a casual reference to sites located elsewhere. Now we shall take up three noteworthy sites on or close to the Sutluj, viz., Bara itself, Kotla Nihang and Ropar (now known as Rup Nagar), all located within a short distance from one another.

The 550 × 300 m large mound at Bara has a 4-m thick occupational deposit, with a very distinctive pottery called the Baran. However, owing to some minor changes the strata have been grouped into Lower, Middle and Upper. The Baran pottery, all wheel-turned and made of fine to medium-grained clay, has a dull brown slip and bears painted designs in black or dull chocolate colour. Not unoften there are incised designs as well which in a way distinguish the Baran pottery from the Harappan. Amongst the most distinctive features of the Baran shapes mention may be made of short and wide stems in many examples of the dish-on-stand, or a ledged projection from the drum part, wherever it exists in the longish stems, the drooping of the rim in the case of the dish constituting a part of the dish-on-stand, pedestalled base for bowls, provision of knobs on the inner side of lids, etc. Amongst the painted designs one notes the absence of intersecting circles, pipal leaves, fish-scales, etc. On the other hand, there are motifs such as a two-horned curve with a tanged arrow in the middle, horizontal or vertical

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series of 'willow'-leaves, solid dots enclosed by horizontal bands, 'eyes' fringed by vertical lines, etc. (Sharma; ibid.: 150).

While the above-mentioned Baran pottery runs all through the occupation of the site, in Sub-period IB there is ample evidence of Harappan contacts. In Subperiod IC the incised designs become shallow and likewise the quality of the paintings gets poorer. Amongst the antiquities special mention may be made of a terracotta object with a 10-cm square base, 17.5 cm height, tapering outline and two bifurcated terminals at the end. Though not exactly similar to the terracotta specimen mentioned above in the case of Banawali Period III, it would appear to fall in the same category. Sanghol and Chandigarh have also produced similar terracotta objects. All these, as surmised earlier, may have had association with some religious cult.

The occupation at Kotla Nihang commences with typical Mature Harappan pottery, but in the upper levels there do occur the Baran sherds, showing a kind of contact with Bara which, as stated above, showed contacts with the Harappans in its upper levels. Of course, this kind of evidence makes it difficult for one to be categorical about the exact chronological horizon of the beginning of the Baran complex vis-a-vis the Mature Harappan, Ropar is the biggest of the three sites dealt with here. The earliest occupation, labelled IA, began with Kalibangan I-like ceramics but was soon overtaken by the Mature Harappans (IB) whose presence is fully vouchsafed not only by the typical pottery but also by chert weights, seals, sealings and even characteristic burial practices. Baran contact, though feebly noticeable in IA, was well in evidence in IB.

In a nutshell, the overall picture in the upper Sutluj valley highlights a local pottery tradition termed the Baran. It is in this milieu that the Mature Harappan made its appearance. However, in due course of time the Harappan elements became feeble and the thrust of the Baran continued.

Looking for new grounds, the Harappans penetrated even the Gaṅgā-Yamunā Doab. This seems to have happened some time towards the end of the third or the beginning of the second millennium BC. In this region three sites call for special attention, viz., Alamgirpur, Hulas and Bargaon.

Of the above-mentioned sites, Alamgirpur was the first Indus Culture site to have been identified in the Doab. Located in Meerut District of Uttar Pradesh, it still remains the easternmost point of the Indus Culture as a whole. It was excavated by Y.D. Sharma in 1958 (*Indian Archaeology 1958-59: A Review*, 50-5).

The excavation brought to light four periods of occupation, with a break in between them all. Of these, the lowest represents a cultural milieu which is not far removed from the Mature Harappan stage. For example, it has yielded a pot bearing an inscription in the Harappan script, while quite a few pot-forms are also familiarly Harappans, such as perforated jars, cylindrical jars, beakers, ring-stands, etc. Some of the painted designs are also typically Harappan; for example, the peacock, intersecting circles, rows of hatched triangles and squares, etc. However, there do occur shapes which are distinctive of the Late Harappan stage. Thus, while some of the dishes-on-stand are of the standard Harappan variety, those with a prominent drooping of the rim of the dish point to a Late Harappan stage. So do jars with long neck and splayed-out rim. The pointed bottom goblet, which occurs in the upper levels of the Mature Harappan stage in the Lower Indus Valley, is also present at Alamgirpur. Amongst other typically Harappan antiquities, mention may be made of triangular terracotta cakes, cubical dice with 1-6 markings on different faces, toy-carts, faience bangles, steatite beads, etc. Impression on a pottery trough provided interesting evidence of cloth. It was made of fine yarn, but had a plain weave.

In the limited excavation no data about the settlement-plan could be obtained, but it was clear that besides mud and mud-bricks, kiln-fired bricks had also been used. Two sizes of these

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latter bricks were noted which were not far removed from the Mature Harappan concept of 1:2:4. However, the size of the settlement is not indicative of its having been a city. At best, the status of a small town could be given to it.

Located in District Saharanpur of Uttar Pradesh, Hulas is also a relatively small mound, measuring about 330×172m. Out of this, according to the schematic section published by the excavator, K.N. Dikshit, the Late Harappan settlement, which is the earliest, accounts for not more than half the area just mentioned (Dikshit, 1982). As to the thickness of the Late Harappan occupation, it varied from 1.4m to 2.4m. All told, therefore, the settlement was neither a big one nor did it have a very long life.

The Late Harappan settlement was bereft of weights, measures and seals. It did yield a sealing bearing three letters of the Harappan script, but without any animal or other motif. There was no systematic laying out of the settlement, not to speak of a grid-patterned planning. Though a few fragments of kiln-fired bricks were no doubt found, it is doubtful if these were used in house-construction. Mud-built houses seem to have been the norm. However, mention must be made of the existence of a large mud platform which, as the excavator thinks, may have been put up as a protective measure against likely floods. There is little to suggest that it was used as a base for any monumental building.

The pottery is characteristically Late Harappan, comparable to its counterpart in the region immediately to the west of the Yamunā, in Haryana. The more noteworthy types are: dish-on-stand with a prominent drooping of the dish's rim; jar with long neck and splayed-out rim; bowl-like lid with a central knob; miniature pots with a pedestalled base. In so far as the painted designs are concerned, these recall the Mature Harappan ones only in such examples as the peacock, row of hatched diamonds, filled and inverted triangles, etc. Otherwise, the designs are more simplistic: for example, linear bands in groups, laid horizontally or vertically. A few of the potsherds also reflect a continuum, howsoever feeble, from the pre-Harappan tradition. Mention must also be made of pots in a grey ware in which such forms as jars with undercut rim or basins with out-turned rim were represented.

The antiquities, amongst others, include terracotta cart-wheels with a raised hub, terracotta 'cakes' either oval with pointed ends or round with deep finger-impressions (the excavator does not reports the flat triangular variety), beads of faience, agate and carnelian (no reference has been made to etched examples), bangles of copper, faience and terracotta, stone querns and pestles and some bone points. It would thus be seen that whereas the repertoire is reminiscent of the Harappan tradition, in its entirety it is not characteristically Mature Harappan.

Another point which deserves to be noted in respect of Hulas is that it does not show any overlap with the subsequent occupation which was that of the Painted Grey Ware. Thus, a Bhagwanpura-like situation is not in evidence here. Perhaps that is understandable since the IB occupation at Bhagwanpura, which represents the overlap phase, is later than the Late Harappan of even Hulas.

Bargaon, excavated by M.N. Deshpande, is tucked up further to the north in the Doab region, and by its very location may have been influenced by features manifest in the Late Harappan of the Sutluj region to the west.

Unlike Alamgirpur and Hulas, it is a single-culture site, there being no subsequent PGW or other settlement. Only two small trenches were laid out, which revealed an occupational deposit of a little over a metre. The published pottery includes the jar having the characteristically long neck with splayed-out rim. Amongst the antiquities one might mention terracotta toy-cart wheels with central hub, terracotta 'cakes' either spheroid or oblong in shape and often bearing finger-depressions, a pot with animal-headed handle, part of a copper celt and some rings, faience and terracotta bangles and a few chert blades. A chert weight (?) has also been referred to but the published photograph (Dikshit, 1984; Pl. no. 112) does not make it

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clear that it is of the standard Mature Harappan type. There is no evidence of kiln-fired bricks not even of mud bricks. Maybe the houses were of mud or, for all one can say, of even wattle-and-daub. All told, it is clear that Bargaon represents a late stage of what may be termed as the Late Harappan. In what manner the story continued later in the Doab requires further intensive exploration in the region. Was there a commingling of a very late Harappan hang-over with the PGW, as it took place in the regions west of the Yamunā?

We may now turn our attention to another domain of the Indus Civilization, viz., to Gujarat which state includes, besides the Gujarat plains, the regions of Kachchha and Saurashtra. Of the many sites explored and excavated, we shall consider here two from Gujarat, viz. Lothal and Rangpur, two from Kachchha, viz. Surkotada and Dholavira, and one from Saurashtra, viz. Rojdi.

The excavator of Lothal, S.R. Rao (1979 and 1985), has divided the occupational strata at the site into two periods called, from bottom upwards, A and B. He further divided Period A into four phases, viz. I-IV, Period B being called phase V. Period A was essentially Mature Harappan, evincing all characteristic features such as seals, sealings, weights, measures, gridiron layout of the settlement, monumental buildings, typical fabric, types and painted designs of the pottery, etc. However, even in Phase IV of Period A one begins to notice certain signs of loss of civic control and decline. For example, there were encroachments on the streets, no construction of public drains and, above all, the Acropolis and warehouse were scarcely used. Likewise, the dockyard too began silting up and went absolutely out of commission in the subsequent phase, viz. V (Period B). This tendency towards decline was also reflected in the pottery. There was an increase in the frequency of the coarse ware. Besides, some new pottery-forms and styles began to come up: for example, bowl with a stud-handle and black-and-red ware with white-painted designs

By Period B, however the decline of the Mature Harappan architectural style and artefactual repertoire and a change-over to some newer elements became very explicit. The Acropolis, warehouse and the dockyard were things of the past. And so too the fortifications were not functional. Even the common men's houses were now of brick-bats collected from the earlier structures; no more was any fresh brick fired. Even wattle-and-daub walls were found to suffice. All this signifies that urbanism was no more there. At the same time, it was the same Harappans, and not newcomers, who were still occupying Lothal. This is clear from the fact that many of the ceramic forms were still the same as in the Mature Phase, though the fabric became coarser and the painted designs less prolific. The usually convex-sided bowl of Period B began to have a carinated profile. The short stud, which had already made its appearance in Period A-IV, became elongated, while the stem part of the dish-on-stand began to squat. Changes were also noticed in other artefacts. For example, the long blades of chert, a material that had been imported from Rohri and was no longer available because of a steep fall in trade, were replaced with smaller blades of chalcedony, agate, etc. Perhaps for the same reason the cubical weights of chert, so diagnostic of the Mature Harappan Phase, were no longer in sight. However, to meet the need spheroid weights of sandstone and similar material were used. The burial practice and worship at 'fire-altars', which did not have to depend either on trade or on economic well-being, continued as before.

The story of this devolution is carried forward at Rangpur, also excavated by S.R. Rao (1962-63). Three occupational periods were identified, viz., I, II and III, with a further sub-division in Period II, called A, B and C. With Period I, yielding a pre-pottery microlithic assemblage, we are not concerned here. Period II A yielded many of the characteristic items that go to make the Mature Indus Civilization, such as cubical weights, use of bricks of typical Harappan size, etc. The pottery too had certain specific Harappan forms, though some local ones, like stud-handled bowls, were also present. A comparative study of the Rangpur II A material with that from Lothal would indicate that the former came into being approximately

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around the time of Lothal IV. Maybe due to a recurrent threat from floods some of the Lothalians moved out and settled at this not-too-far-off site, hardly 50 km away, Rangpur IIB and IIC evinced a further decline in the material culture. Although Period IIB accounted for as thick a deposit as 3.6 metres, no evidence was found for the use of kiln-fired bricks, nay even of sun-dried bricks. On the contrary, the presence of post-holes suggests the use of only wattle-and-daub structures. In such a decline who would bother about a system of drainage? It had become patently a village scenario, Period II C, however, showed some evidence of picking up. For example, the pottery was given a relatively better look by applying a lustrous red slip. The economic condition also seems to have somewhat improved, as reflected by the occurrence of some metallic objects. Though perforated jars, beakers and goblets were no longer to be seen a few basically Harappan forms such as the dish-on-stand, heavy-rimmed jars, etc., continued. However, these too showed certain changes, for example in the former case the stem became shorter. Amongst the painted designs some new elements were introduced, such as the running antelope, or bull with curly horns. A hang-over from the Harappan times is also discernible from the graffiti on pottery, some of which resemble the signs of the Harappan script. On the religious side, the continued used of 'fire-altars' is also attested to. The occurrence of cubical dice marked with 1-6 dots in this Subperiod (as also even in the succeeding Period III) shows the continuity of the game concerned right from the Mature Harappan times.

The small-scale pick-up evidenced in Period II C, however, became more apparent in III. For example, the lustrous pottery (called the Lustrous Red Ware) became the dominant ceramic industry of this period. Likewise, paintings involving a variety of motifs, old and new, became relatively more prolific. The black-and-red ware with white-painted designs, which had started as early as Period II A, became more conspicuous by its presence. Graffiti on pottery reminds one of the struggling-to-survive Indus symbols. Use of mud-bricks in house-building was also noticed. However, in spite of the foregoing signs of some advancement, Rangpur continued to be a small settlement. The region thereafter never witnessed urbanism for ages to come.

Surkotada, in Kuchchha, was excavated by J.P. Joshi (1990). It is a smaller settlement than Lothal and also differs from the latter in its layout. Thus, whereas Lothal had within a single fortified area an acropolis on a high platform and the general habitation on the normal low ground, Surkotada had two juxtaposed fortified areas, both of the same size. As far as one can make out, both the parts have structures of almost the same nature. To put it in other words, what has been called the 'Citadel' has not yielded any specifically outstanding structure, such as those found in the Citadel complex at Mohenjodaro or Kalibangan or on the Acropolis at Lothal. The overall smallness of the settlement of each part measures no more than 60 × 60 metres internally, might suggest that it was not quite like the other Harappan centres, but may have had some specific restricted function to perform. Had the excavator come across some military 'hardware', one would have thought of the site in terms of a military station. Perhaps its intermediary location between Sindh and Gujarat may offer some kind of explanation.

Anyway, that Surkotada was a settlement of the Mature Indus Period cannot be gainsaid. The excavator has divided the occupation strata into three Sub-periods, viz. IA, I B and I C, there being, however, no break in between. While Sub-period I A yielded almost all the characteristic artefacts and pottery of the Indus style, it yielded, though in a very small percentage (7 percent only), pottery-fabrics which are somewhat different: for example, a polychrome red-slipped ware, a reserved slipped ware, and a deep amber-red slipped ware. Subperiod I B was a continuum of I A, except for the fact that a coarse red ware dominated over the typically Harappan black-on-red, indicating that some change was in the offing. An altogether new pottery element that made its appearance in Subperiod I C was that of a white-painted black-and-red ware. Another notable point was the presence of a layer of ash between

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Subperiods I B and I C, but the fact that Harappan elements continued in I C clearly indicates that there was no break of occupation. For example, from this Subperiod came a terracotta seal with Indus script, a cubical chert weight, stone gamesmen, etched carnelian beads, etc.

That even Subperiod I C did not witness decline of the kind evidenced, for example, at Rangpur seems to be clear. For whatever reason, the site was abandoned around 2000 BC or slightly later, as shown by the Carbon-14 dates for Subperiod I C: as many as three range around 2000 BC, and one gets into the nineteenth century BC. It is only after this time that the real decline of the Indus Civilization set in. (At Lothal the signs of decline had appeared slightly earlier, because of the local conditions, in particular because of the menace of floods which rendered the dockyard, wharf and warehouse out of commission and brought all trade to a grinding halt.)

The excavations at Dholavira by R.S. Bisht, are still (1992) in progress. However, the site has shown surface-evidence of a plan which is quite different from that known from any other Harappan city. Here the settlement was divided into three major parts, all juxtaposed to one another and provided with fortifications. The highest but smallest part has been named the 'Citadel'; a little lower but bigger than it, the Middle Town; and the largest but the lowest, the Lower Town.

While a formal periodization of the occupation-strata has yet to be published, a cyclostyled paper by the excavator, captioned 'Dholavira; New Horizons of the Indus Civilization', informs us of the existence at the site of 'Pre-Indus, and early mature, late mature and post-urban Indus periods or phases'. The earliest phase, accounting for a deposit of 60-70 cm, was completely bereft of any typically Indus antiquities or pottery. However, the cultural level was that of Copper/Bronze Age all right, as attested to not only by the occurrence of metallic objects, but also by the evidence of copper-working at the site. The accompanying pottery included a variety of fabrics, painted designs and shapes: for example, a pinkish ware decorated with incised horizontal grooves on the body, reserved-slip ware, white-painted ware, etc. The next phase, accounting for a substantial deposit of 10 m, was characterized typical Harappan material which included seals, sealings, weights, terracotta 'cakes', cart-frames, inlay pieces, etc. In the pottery, however, the classical Harappan examples were not so profuse. A coarse red ware seems to have dominated the scene, besides which buff, white and cream-slipped wares were also present, though in small quantities,. In the next phase, called by the excavator as 'Late Mature', a change began to set in. For example, the seals became smaller and usually devoid of animal figures. In ceramics, Jhukar-like paintings on the one hand and black-and-red ware on the other made their appearance. As time passed, civic norms were given up. Jerry-built structures were put up at all sorts of places. The excavator thinks that 'something drastic occurred and the city lost its glory and grandeur and also its urban character. With the result, the city was rapidly abandoned by the administrative authority and the affluent people. Only the poorer folks and artisans stayed on.' After a break, the site was re-occupied and though the houses constructed were circular in plan, there is reason to believe, on the basis of the pottery used, that the occupants were descendants of the Harappans themselves. With the dwellings scattered in all sorts of places and having very thin deposits, it has been surmised that a sort of nomadism had set in. After this phase the site was completely abandoned.

At the time of writing no Carbon-14 dates for Dholavira are available to the author. However, what has been termed as the 'Late Mature Phase' by the excavator may broadly be compared to Surkotada I C and may have ended by about 2000 BC. The nomadic phase may thus be assigned to the first quarter of the second millennium BC.

The occupation at Rojdi (Possehl and Rawal, 1989) has been divided into three phases called A, B and C. Very broadly, the pottery of Phase A is comparable to that of Rangpur II A. Thus, many of the very typical Harappan forms are not there and likewise, as the excavator

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puts it, the 'distinctive Indus painting style is absent'. Town-planning and monumental structures like those at Dholavira or Lothal are also not there, though remnants of a circumambulating wall do seem to be present. Seals are wanting, though knowledge of writing is attested to by (just) one inscribed potsherd. There are quite a few other sites similar to Rojdi and Possehl has given the complex a new name, viz. 'South Harappan'. One thing, however, deserves to be noted, namely that the Carbon-14 dates do carry the beginnings of Rojdi back to *circa* 2500 BC. On the basis of these dates, the habitation at Rojdi may have continued for a while even after 2000 BC.

While Rojdi and a few more of its ilk were regular settlements with reasonable-sized stone structures and persisted for a long time, Saurashtra has thrown up many sites of late Harappan vintage which can be regarded only as 'small rural villages or dry-season pastoral camps' (Bhan, 1989). A statistical analysis by Bhan of the sites in the State of Gujarat, including Kutch and Saurashtra, is very revealing. Thus, whereas there are only 20 Mature Harappan sites in the entire region, the number of sites ascribable to what he terms as 'the initial phase of Late Harappan' is as large as 152 and that of the 'final phase of the Late Harappan' is 79 (Bhan, ibid.). Another noteworthy feature of this distribution pattern is that of the 20 Mature Harappan sites as many as 14 were in Kuchchha. On the other hand, Kuchchha has produced only 5 sites of initial Late Harappan phase and just 2 of the 'final Late Harappan'. It seems that after having served as a corridor during the Mature Harappan period. Kuchchha was, as it were, abandoned, most probably because of the inhospitable terrain. Or, had the Rann also started silting up, making the region unworthy for sea-borne trade?

Having discussed above the decline and subsequent transformation of the Indus Civilization in different regions of the subcontinent, we may now take stock of the legacy left behind by this Civilization. There could be two aspects of this legacy, viz. (*i*) material, i.e. that which can be identified in terms of the actual remains available now from sites dating from after the decline, and (*ii*) that non-material content which may be reflected in religious beliefs, social stratification, etc., in subsequent eras. For obvious reasons, the former would be more objective, whereas in the latter case an element of subjective interpretation is bound to creep in. While discussing the legacy, it would be well worth while also to consider items which are conspicuous by their absence in the cultural milieu that followed. This comparison, or better contrast, between what survived and what did not might perhaps help in identifying some of the causes of the decline.

The tangible items may be classified under certain categories such as those relating to agriculture and other subsistence pursuits, domestic chores and implements, ornaments and other related objects, transport, etc., as detailed below.

Though no agricultural field has been found which can be ascribed to the Mature Harappan phase, the pre-Harappan (or formative Harappan) occupation at Kalibangan was found associated with an agricultural ploughed field (Lal, 1970-71), and it is only reasonable to assume that the same kind of ploughing system also continued during the Mature Harappan times as well. The characteristic feature of the Kalibangan field was its criss-cross pattern of the furrows. These lay in two sets, one running north-south and the other east-west. The distance between the individual furrows in the former set was more than that in the latter, viz. 1.9 m as against 30 cm in the latter. It is interesting to note that this kind of grid-patterned furrowing, with one set having a wider intermediary space than the other is in vogue even now in northern Rajasthan, Haryana, Punjab and western Uttar Pradesh. What is done now is to sow small plants of horse-gram in the narrower east-west rows and the relatively taller mustard plants in the widely spaced north-south rows. This differentiation in spacing is done consciously. These crops are grown in winter when the sun is in the southern hemisphere. Thus the tall mustard plants are laid in the north-south rows so that they do not prevent the sun-rays from falling on the smaller horse-gram plants. It is

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reasonable to assume that the same logic must have guided the pre-Harappans some 5000 years ago.

Along with the survival of the aforesaid system of field-ploughing may be mentioned the kind of ploughshare used during the Harappan times. Although a few terracotta examples had already been found at Mohenjodaro and Harappa, these were broken and thus their identification remained a matter of doubt. Recent excavations at Banawali in Haryana have brought to light a very good terracotta model of a ploughshare. It consists of a curved beam and a sharp-ended 'shoe' (Bisht, 1987: Pl. 26). More or less similar ploughshares are still in use, not only in Haryana but also in the above-mentioned neighboring states.

A terracotta model of an axe fitted to a handle found at Mohenjodaro (Mackay, 1938: Vol. II, Pl. CXII, 1) reminds one of the use of similar axes even nowadays in the countryside, for cutting fire-wood for cooking purposes as also for felling trees in the jungle. Similar to what are in use today are the fish-hooks found at almost all Harappan sites (for example, Marshall, 1931: Vol. III, Pl. CXLIII, 24-25).

The usual pattern of an average Harappan house (not of the more fastidious ones in the big cities) was to have an open courtyard surrounded on three sides with living rooms and having a large frontal entrance into the courtyard through which bullock-carts and cattle could get in. In the courtyard have also been found troughs for keeping fodder and lower parts of large pots for holding water—all meant for the cattle (cf. Lal, 1979: 83-5). Immediately outside the house, flanking the gate, were platforms evidently for people to sit on and chat. The roofs of the rooms were flat, made of wooden beams and reed-matting interspersed with earth. Cooking was usually done in the courtyard. This pattern of house-plan still persists in the rural areas of Haryana, Punjab etc.

Even certain items relating to cooking seem to have survived the millennia. For example, the present-day overground and underground *tandūrs* in northern Rajasthan, Haryana and Punjab may well be said to go back to the pre-Harappan times, This is duly vouchsafed by the examples encountered at Kalibangan (Lal, 1979; 68-9). The three-legged *pātā* (also called *chakalā*) used for preparing the bread these days has surprisingly its counterpart in the Harappan milieu. (See, for example, *Indian Archeology 1958-59—A Review.* Pl. LXVC for a Harappan specimen from Alamgirpur in Uttar Pradesh.) Even the saddle querns and mullers used these days in the villages are not much different from their Harappan ancestors.

Though the Harappan pottery-forms had started changing in the late phases and were no longer to be seen, except for a few examples, in the transformed cultural milieu, yet some forms have strangely survived till today. For example, the *kamaṇḍalu* (Mackay, 1938; Vol. II, Pl. LXVI, 22,28) and small nozzled vessel used for feeding children with milk (Mackay, 1938; Vol., II, Pl. LXVI, I) have their counterparts even today.

In the style of wearing ornaments and amongst toilet objects there are quite a few instances which seem to have continued through the ages. For example, the Marwari ladies of Rajasthan wear a large number of bangles on their lower and upper arms reminding one of the manner in which the famous dancing figure from Mohenjodaro did (Marshall, 1931; Vol. III, Pl. XCIV, 6-8). An engraving on a stone stele found at Banawali (Bisht, 1987; 150) shows a person wearing a *ḍamaru*-like armlet and wristlet, which reminds one of a similar ornament worn by women folk in Rajasthan and Gujarat. The anklet (*pāyala*) worn by another figure from Mohenjodaro (Mackay, 1938; Vol., II, Pl. LXXIII, 5) is still used by Indian women, sometimes disappearing from and at others re-emerging on the fashion scene. The gold hollow cone (called *chauk* in Hindi; Marshall, 1931; Vol. III, Pl. CXLVIII A,2) is used even now on the forehead by the ladies of Rajasthan and Haryana. Referring to it Vats (1940; 442) says: ' By Hindus in northern India *chauks* are regarded as the essential ornaments which every man, rich or poor, has to give at the wedding of his daughter-in-law. This ornament is now worn chiefly on religious and important domestic ceremonies only.' Reference may also be

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made to girdles worn by the Harappan terracotta figurines (Mackay, 1938; Vol., Pl. LXV, 21,22, etc.). While girdles have almost gone out of fashion in urban areas, one may still see them around the waist of womenfolk in rural north India. Spiral finger-rings, though of a rather universal character, may not be out of place to be mentioned in the present context as well.

Speaking of toilet objects one is specifically struck by at least two items. At Harappa had been found a set comprising three small items, viz., a tweezer, a pointed tiny rod and a somewhat flatish object (Vats, 1940; Vol. II, Pl. CXXV, I). A set of three more or less similar objects is still sold in the market. On enquiry it is learnt that the tweezer is used for plucking unwanted hair from the inner side of the eyelid and the pointed rod is used for cleaning the interspaces between the teeth. In the modern set, the third object has sometimes a tiny cup at its end and is said to be used for removing mucus from inside the ears. The square-shaped comb of ivory, with a broad central part and teeth on opposite sides (Mackay, 1938; Vol. II, Pl. C, 15), has its exact parallels even now, though in the urban areas plastic combs with teeth on one side only have replaced the same. In rural areas wood instead of ivory is more common material, since the poor people can ill-afford the luxury of having ivory combs. Amongst other toilet objects mention may be made of antimony rods (e.g. Vats, 1940; Vol. II, Pl. CXXV, 33) and nail-parer (Vats, ibid., 39) which have their exact counterparts even today.

Amongst the objects relating to games, particularly for children, the Harappans had a variety of terracotta figurines, discs, masks, whistles, rattles, etc., which are common even now, specially in rural and semi-urban areas. However, the game of chess, evidenced by the gamesmen (Rao, 1985; Vol. II, fig. 103; pls. CCXVII B and CCXXI A) needs to be drawn specific attention to. The game is still played in India, although we do not have so far archaeological evidence about it during the intermediary period. Likewise, the cubical dice marked with 1,2,3,4,5 and 6 dots respectively on its six faces, is used in certain games even now, though intermediary history is not yet known.

In the matter of transport, one would like to draw attention to terracotta models of carts and wheels found at most Harappan sites (e. g. Marshall, 1931; Pl. CLIV, 7 and 10). That the cart reconstructed from these clay specimens resembles the modern Sindhi cart had already been suggested by Marshall (1931; Vol. II, p. 554 and Vol. III, Pl. CLIV, II). However, no less interesting than the configuration of the vehicle is the fact that even the gauge is still the same. Wheeler's excavation at Harappa in 1946 brought to light the ruts, the distance between two corresponding ones being 1.08 m (Wheeler 1947; p. 85 and Pl. XXXV B). This is identical with the gauge of the carts used in that area even now. Indeed, tradition dies hard ! In this context one might also draw attention to a copper model of a vehicle found at Harappa (Vats, 1940; Vol. II, Pl. CXXV, 35). It reminds one of the *ekkā* used these days in eastern Uttar Pradesh, though the two are not absolutely identical.

We may now turn our attention to certain aspects which are relatively less tangible and about which only a reasonable guess can be made. A lot has been written about the Indus religion. However, since the Indus script has not been deciphered so far one cannot be too sure of one's interpretation. For example, had the script been read, one would have known what the inscription at the top of the famous seal has to say about the central figure, seated in a yogic posture and surrounded by animals (Marshall, 1931; Vol. I, Pl. XII, 17). Marshall identified this figure with Śiva in his *Paśupati* (Lord of Animals) aspect, and thought that the three faces may be the forerunners of the later-day concept of the Trinity (Marshall, 52-5). On the other hand, a recent paper avers that the figure may not even be a male and seeks to identify it as the 'Lady of the Beasts' (Dhavalikar and Atre, 1989). However, the general consensus seems to favour the view propounded by Marshall.

In support of the prevalence of a kind of Śaivite religion during the Indus times, Marshall identified certain objects as *liṅgas* (Marshall, 1931· Vol. I, Pl. XIV, 2,4) and some other as

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probable *yonīs*; Pl. XIV, 6,8). While one cannot be too sure of these objects being *liṅgas* and *yonīs*, it is, at the same time, an idea which cannot also be straight away set aside.

A cult of the Mother Goddess seems to be suggested by a large number of terracotta female figurines found in the Indus context (Marshall, 1931; Vol. III, pls. XCIV-XCV). This cult, however, seems to have been less prevalent in and even absent from some of the sites in the upper Ghaggar and Gujarat.

Worship of trees such as the pipal (*ficus religiosa*) and of tree-deities seems to be attested to in the Indus Civilization (see, for example, Marshall, 1931; Vol. I, Pl. 18; Vol. III, Pl. CXI, 355, Pl. CXII, 387). Likewise, there is indication also of animal-worship (Marshall, 1931; Vol. I, 66-67).

The foregoing are some of the religious concepts of the Indus Civilization which seem to have survived the millennia and may be found in vogue in India today. While the worship of Śiva, *liṅgas* and *yonīs* is rather universal, that of trees and animals seems to be more prevalent in rural areas as compared to the urban ones.

Animal-sacrifice is yet another religious practice which seems to have continued since the Indus times. At Kalibangan has been found a brick-lined sacrificial pit with bovine bones in it (Lal, 1979; 78-9). In further support of animal-sacrifice may be cited the engravings on a terracotta cake from the same site. On one side is shown an animal with a noose around the neck, the rope being pulled by a person in front of it. On the other side is a figure that seems to be identifiable as a deity because of the typical head-dress. The overall portrayal seems to be that of an animal being led on to be sacrificed before a deity.

Though not quite under the category of religion, one may nonetheless refer to the practice in the Indus Civilization of what appear to be similar to the present-day yogic *āsanas*. This is suggested by certain terracotta figurines (cf. Rao, 1973; fig. 35). We have textual evidence also relating to yogic *āsanas*, ascribable to a time almost midway between now and the Indus period; the reference is to Patañjali's *Yogasūtra*, dating to about the second century before Christ.

A kind of social stratification seems to have existed during the Indus times. A somewhat detailed analysis of the available evidence was presented by this author in a paper read at a conference on 'The Origins of the Indian Civilization' in Bologna, Italy, in September 1992. Here it may perhaps suffice to recapitulate the entire evidence very briefly, as follows.

The Indus settlement at Kalibangan is broadly divisible into three segments. A so-called 'Citadel' on the west, a 'Lower Town' on the east—both of which were fortified, and an unfortified area to the south of the Citadel. The Citadel was further divided into two halves by a partition wall in the middle. In the southern part there were a series of rather high mud-brick platforms, separated one form the other by passage-ways. Although on account of nearly four thousand years of weathering activity, the upper parts of most of these platforms have been eroded, at least in a few cases it was possible to identify the nature of the structures thereon. Thus, in one case there lay seven contiguous 'fire-altars', each with a central stele, running in a north-south direction. (These fire-altars are not to be confused with those used at present by the Parsis in India.) Nearby was the lower part of a pot full of ashes and charcoal, in which perhaps fire was kept in readiness. On the same platform there were a brick-lined well and a bathing pavement with drain. It thus appears that those who offered worship at these fire-altars were perhaps required to have a ceremonial bath, most likely before the ritual.

On another platform there was a brick-lined pit with bovine bones, indicative of a ritual involving animal-sacrifice. As stated earlier in a different context, there is other supporting evidence for animal-sacrifice. In the northern half of the Citadel, which was connected with the southern half by means of a stepped passageway through the partition wall, there were residences most probably of the priests who were supervising the rituals in the southern half.

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As against the layout of the Citadel, the Lower Town had a number of north-south and east-west streets, producing a grid-pattern and dividing the habitation into a number of blocks. Each block consisted of a number of houses and each house followed more or less the same pattern, viz. a large courtyard with a number of rooms on three sides and a large entrance, wide enough to admit a bullock-cart, on the fourth. As stated earlier, in the courtyard there were a series of troughs containing fodder as also the lower parts of pots to hold water, evidently for the bullocks and other domesticated animals. Quite often a room was reserved for storage of cereals. It is evident that houses such as these belonged to farmers. Likewise, the presence of seals in some of the houses indicated that the occupants may have engaged themselves in some kind of trade in which the seals were used, as these are done even now, for sealing packages to be sent out. The picture thus is that the Lower Town was inhabited principally by a merchant-*cum*-farmer community.

In the unfortified area, though not excavated *in extenso,* the houses were rather small. Also on the fringe of this area a large amount of broken pottery was discovered, suggesting that nearby was a potter's kiln.

Looking at the overall evidence from Kalibangan, it seems that there were at least three segments of the society: viz., a priestly class occupying the Citadel, a merchant-*cum*-farmer class dwelling in the Lower Town, and a much less privileged class living out in the unfortified area to the south of the Citadel.

The evidence from Lothal, Harappa, as also Mohenjodaro, discussed in detail in my above-mentioned paper, duly supports the existence of the kind of social stratification indicated at Kalibangan. Thus, it appears that the Indus society as a whole had a three-fold division as just discussed.

These divisions seem to have been based partly on religious grounds, as in the case of the priestly class inhabiting the Citadel, partly on agricultural activity and economic affluence as in the case of the merchant-*cum*-farmer class of the Lower Town, and partly on supposedly inferior kinds of jobs and economic deprivation as in the case of those living in the unfortified area at Kalibangan or in the so-called barracks in the shadow of the Citadel at Harappa.

While it is always risky to look at the past in the light of what obtains at present, it may not be quite unreasonable to pose a question: Did the above-mentioned three classes give rise, in course of time, to the three classes of later-day Indian society; the Harappan priestly class to the Brāhmaṇas, the merchant-*cum*-farmer class to the Vaiśyas and the under privileged lower working class to at least some amongst the so-called Śūdra community? In the Indus Civilization, there is not much evidence of military equipment and, therefore, it would be unwarranted or visualize a separate warrior class in it. The Kṣatriya class may, therefore, have come into being later on as and when the need arose.

In the foregoing pages, we have surveyed various items of material culture, as also religious practices and social institutions which seem to have come down to us as a legacy from the Indus Civilization.

We may now take stock of items which seem to have declined and finally disappeared with the fall of the Indus cities. The most noteworthy amongst these are the famous Indus seals. Although a slightly different kind of seals did continue in the 'Jhukar' phase of Chanhudaro, even these were not to be seen thereafter. In Punjab, Haryana, etc., in the north and in Gujarat in the south, there is no evidence of the use of seals after the middle of the second millennium BC.

Another noteworthy casualty was that of the weights. Although attempts have been made by scholars (e.g. Mainkar, 1984) to suggest that the Indus weight-system is enshrined in Kauṭilya's *Arthaśāstra,* there is absolutely no evidence of the typical cubical Indus weights in the cultural milieu after the middle of the second millennium BC. The weights used in the Gangetic valley from about the middle of the first millennium BC, are cylindrical. These do

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not seem to have been studied in detail and at least in the present state of our knowledge it is difficult to link them with the Indus weights. In any case, how does one account for the long gap of over one thousand years, from about the middle of the second to the middle of the first millennium BC? No site assignable to this interval has yielded any weight, either of the former or of the latter type.

Likewise, the Indus system of measuring length was also discontinued. Thus, whereas there did exist regular graduated scales during the Indus times, no such scale is available, not only for the intermediary period, viz., 1500-500 BC, but also during the early historical times say from 500 BC to AD 200. That there was no graduated scale during this period is also indicated even by the *Arthaśāstra* which records the measuring of length with the help of the various parts of the human body, viz., *aṅgula* (finger-with), *vitasti* (span), *hasta* (cubit), etc. (The present author is not aware of any graduated scale recovered from any of the early historical sites. He would be grateful for any positive information in this regard.)

There are some who hold that the Brāhmī script of the early historical times had been derived from the Indus script. This too is highly debated and, as the evidence stands at present, it is a doubtful proposition.

Town-planning and use of kiln-fired bricks along with their standardization seem to have vanished with Indus urbanism. Regular use of kiln-fired bricks re-appeared only during the early historical times, but not only was the size different but the Indus standardization was also no more to be seen. (In this context attention may be drawn to Lal, 1986.)

A review of the Indus legacy in terms of what has been completely lost and what has survived makes one thing clear, viz., what disappeared was related essentially to trade, commerce and consequential urban life, and what has continued is associated with agriculture, household chores, ornaments, transport, religious beliefs and practices and social stratification. These surviving traits are part and parcel of the common man's life and are not dependent on affluence in trade or urbanism. A critical study of this dichotomy of the legacy easily explains the archaeological phenomenon that we encounter after the fag-end of the Indus Civilization, viz. the winding up of city-life and a backward move to villages of which hundreds have been recorded in Punjab, Haryana, Rajasthan and Gujarat. Sindh has not been thoroughly combed. If done, it may perhaps also yield a similar picture.

To put the tale synoptically, the Indus cities collapsed, the civilization declined, but the people survived it all, though bereft of their glorious past. Their great, great-grandfathers had brought into being these cities—gradually from a village economy to that of a town and through great strides to that of a city. The decline of the civilization entailed an end of the cities and reversed the direction. To borrow a simile, the Indus urbanism may be likened to a storm on the vast ocean of Indian time, which raged, held on for some time but finally subsided, leaving the waters placid as before; cities came and went, but the villages kept on for ever!

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CHAPTER XV

Chalcolithic Cultures and Technology in India

D.P. Agrawal

I summarize here the latest archaeological evidence now available for the period from the third to the early first millennium BC, with special emphasis on copper technology. Also included are the chronologies based on the latest radiocarbon and thermoluminescence dates. In the Indian subcontinent this period was characterized by the use of copper although stone blades continued to be used. As the Indian subcontinent did not have a unified, unilinear socio-economic evolution during this period, some of the cultural terms have special connotations in Indian archaeology. Here we have included the Harappa, the Banas, the Kayatha, the Malwa, and the Jorwe cultures, as all of them used copper and stone. The Copper Hoard culture is also discussed, though one does not have adequate data regarding its total archaeological assemblage. During the protohistoric period, the Harappan, the Chalcolithic and the Copper Hoards were the three main copper-using cultures. The Chalcolithic group includes exclusively non-urban cultures. Whose economy was akin to the non-metal-using Neolithic cultures of the South. The third group is called the Copper Hoards culture, so named because most of the finds were in hoards.

HARAPPA CULTURE

The Harappa culture (or the Indus civilization) is well known for its uniformity and standardization in weights, measures, ceramics, architecture, town planning, and in other arts and crafts. When one considers that the culture extended over more than a million square kilometres, an area larger than that of Pakistan today, from Sutkagendor (Makran) in the west, Alamgirpur in the east, to Rupar in the north, and to Bhagatrav in the south (Fig. 1), the uniformity appears so amazing.

The following traits define the Harappa culture (Wheeler, 1968) : (1) Indus seals; (2) Indus script; (3) motifs like intersecting circles (Fig. 2) ; (4) ceramic forms like goblets with pointed base, cylindrical pots with multiple perforations, jars with an *S*-shaped profile (Figs. 2 and 3) and dishes-on-stand; (5) triangular terracotta cakes; (6) kidney-shaped inlays of shells or faience; and (7) certain beads, notably discoid with tubular holes; (8) gridiron town planning; (9) and standardized brick dimensions in the ratio of 1:2:4.

Expectedly, there are regional cultural variations in the Harappan distribution area. In Gujarat and Rajasthan, there are no mother goddess figurines (Fig. 4) or the phalli of the Sindh. The fire altars at Lothal (Gujarat) are different to those of Kalibangan (Rajasthan, Fig. 5). Although uniform standards were perhaps imposed over artifacts for mass consumption

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and trade, local differences in culture and religion continued to thrive (Agrawal, 1993). Even today the Harappan zone has several linguistic provinces: Gujarati, Punjabi, Sindhi, Baluchi and Hindi.

It has to be noted that fortification of towns, stone blade technology, copper metallurgy, steatite beads, standardized brick sizes, several ceramic motifs, terracotta cakes, bullock-carts, and so forth are all contributions of the Early Harappans to the Indus civilization.

Astronomical Ringstones

When the excavators discovered extremely well-polished limestone (or chert) and massive ringstones at Dholavira, the feeling was that these are some unique finds in the whole Harappan repertoire. No one knows that many such stones have been found at Mohenjodaro and Harappa (During Caspers, 1991), they seem to be an important part of the Harappan assemblage. I had suggested to the excavator that their positioning in the southern gate suggests an arrangement for determining the winter solstice. Now I have discovered that Maula (1984: 159-70) has also suggested the astronomical importance of the Mohenjodaro ringstones. He says:

> In some specimens of 'great ringstones' of Mohenjodaro, which can be described as flattened spheres, there are two smaller holes on either side of the central hole, and a number of even smaller holes drilled on the smooth surface. In three cases the pattern of these small spots is sufficiently well-preserved to admit an exact measurement of their azimuths from a point determined by an isosceles triangle with its height equal to its base, the latter connecting the two holes on either side of the central hole. These 'great ringstones' (HR 5924 = MM 1407, HR 5929 = MM 1406 now in Mohenjodaro, and, HR 20810 (E) now in Bombay) are shown to be azimuth calendars for the latitude of Mohenjodaro by computing the dates corresponding to the azimuths of the small spots in 2500 in 2000 BC., which establishes their synchronization.

Maula claims that these ringstones 'served not only as the earliest known calendric instruments in history but also as observational instruments in naked-eye astronomy, suitable for studying sunsets and sunrises, heliacal risings and settings of other heavenly bodies, and planetary phenomena. (Maula 1984 : 159).

Figure 11.8 (During Caspers, 1991: 91) is strongly reminiscent of the southern gate of Dholavira. The alcove on the wall with a stone is very suggestive of the Mayan devices for determining the winter solstice whereas the limestone tops on pillars may have served some purpose in the railings for some sacred tree/structure. The two such pillars at Dholavira seem to support During Caspers suggestion.

Crafts

Factories for bead-making have been discovered at Chanhudaro (Mackay, 1943) and Lothal (Rao, 1973). Beads were made of agate, carnelian, faience, shell, terracotta, gold, silver and steatite. Beads with inlay work and etchings were probably exported.

The Harappans had a very highly standardized system of weights and measures. Two systems of measurement were used : cubits and long foot. A cubit was about 52 cm (52.5-52..8 cm) and the long foot was 33.5 cm. Graduated scales with decimal graduations up to 1.7 mm have been reported. The cubical stone weights followed a binary system (1,2,4,8,16,32 up to 12,800) in the lower denominations, and also the traditional Indian ratio of 1 to 16 (1 seer = 16 chhattacks may derive from this). The unit weighs 13.625 gm. Higher weights follow a decimal system with fractional weights in thirds. Throughout the Harappan territory, and even in the Dilmun (Bahrain) area, the uniformity and accuracy of these weights and measures were maintained.

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Earlier it was thought that Kot Diji and Kalibangan Period I represented the pre-Harappans. Mughal (1970) has now shown that these cultures represent only the early phases of the Harappa culture. Fortifications and some degree of planning are evident both at Kot Diji and Kalibangan in the Early Harappan contexts. For protection against floods, the citadels and the lower town buildings were built over raised mud-brick platforms. The settlement was divided into a citadel, which was on a higher ground, located in the west, and the lower town towards the east. The citadel was always fortified and often the lower town also. Harappa and Mohenjodaro and Kalibangan have remarkably similar plans, with fortified citadels west of the lower town. At Kalibangan, the lower town also had a fortification, and at Lothal (Fig. 6) and Surkotada both the citadel and the lower town are enclosed by a common wall. At Surkotada, the two are separated by a further wall. At Lothal there is no wall between the lower town and the acropolis, and the latter is situated in the southeast—a unique location. Banawalli shows a very different town plan. Houses were provided with wells, drains, and latrines.

Trade

The magnitude and significance of the international trade of the Harappans is quite a controversial issue, as lucidly summarized in the recent book, *The External Trade of the Indus Civilization* (Chakrabarti, 1990). The significance of trade was minimized by Fairservis (1971) and Lamberg-Karlovsky (1972), though Rao (1973) and Ratnagar (1977) laid great emphasis on it. During Caspers (1972) has made critical surveys of trade in the third millennium BC and Mughal (1970) has pointed out that there is considerable evidence of trade contact from the Early Dynastic III period. This means that international trade began from the Early Harappan times and was not confined to the Mature Harappan period only.

Religion

Though there is controversy about the use of the Indus seals, they seem to have served both religious and secular functions. The discovery of the seals in the Lothal warehouses clearly suggests that they were used to seal grains or merchandise, but a majority depict scenes which could only be religious. A well-known seal, depicting a seated, three-faced horned and ithyphallic figure surrounded by a number of animals (Fig. 7), recalls the *paśupata* (animal loving) nature of Śiva. It may be relevant to recall here that an elaborate 'horned' deity motif has been reported from Kot Diji, Burzahom (a Neolithic site of Kashmir) and, more recently, from Padri (Fig. 8). Padri is a recently excavated site in Saurashtra marked by its Pre-Harappan and Harappan deposits, spouted pots (normally not a part of the Harappan repertoire) and a 14 cm long fish hook (Shinde, 1992). A terracotta cake from Kalibangan shows a standing human figure with a horned head-dress; on its reverse a man is carrying, perhaps for sacrifice, a goat or a bovine tied with a rope (Fig. 9). In the religious sector of the citadel at Kalibangan, bovine and antler bones and ash were discovered in a pit, probably indicating a sacrifice (Thapar, 1973). The discovery of several naturalistic stones and terracottas and perforated stones (perhaps depicting female organs) from the Harappan sites in Pakistan may allow us to trace the present *Śivaliṅga* and *yoni* worship back to Harappan times. A nude male stone torso from Harappa also appears to be ithyphallic, recalling the *yogīśvara* (master of senses) aspect of Śiva. Even in later sculptures Śiva is depicted as ithyphallic. Another male statue from Harappa shows a nude male in a dancing pose, reminiscent of Śiva's cosmic dance. Thus the latter day elements of the Hindu gods were already there in the Harappa culture. The Indus civilization thus seems to provide the substratum to the latter-day Indian civilization (Agrawal 1993).

The nude terracotta female figurines (Fig. 4) with their elaborate coiffures may indicate a mother goddess cult. Such cults seem to be widespread from Turkey to Iran from the Neolithic times onwards and they continue in India even to this day.

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It is curious to note that terracotta figurines are missing both from Kalibangan and Lothal. On the other hand, fire altars, seven in a row, were found on the citadel at Kalibangan along with a sacrificial pit containing animal bones. Outside the main settlement, a structure housed five such altars and each house also seems to have had such an altar (Fig. 5) (Lal, 1979). Different types of fire altars were reported from Lothal also, but none from the main Indus sites.

Graves

Examples of graves lined with bricks are rare, though not unknown. The Harappan R-37 cemetery has a unique example of a rosewood coffin with a lid of deodar (Wheeler, 1968). The burials seem to indicate a mixed population or a social stratification at Kalibangan (Thapar, 1973). There are inhumations; urns inside circular pits; and there was one subrectangular pit containing only pots without any skeletal remains (Fig. 10). All grave goods are typically Harappan (Lal, 1979).

Chronology

The time bracket of approximately 2500-1500 BC for the Harappa culture was based upon the discovery of Indus objects in West Asian archaeological contexts and of the Mesopotamian artifacts in the Harappan sites (Wheeler, 1968). Agrawal proposed BC 2350-1750 for the nuclear and BC 2200-1700 for the peripheral zones of the Harappa culture on the basis of uncalibrated ^{14}C dates (Agrawal, 1964).

Quite a large number of radiocarbon dates is now available for the Harappan sites (Agrawal and Kusumgar, 1974; Agrawal, 1982; Shaffer, 1992). Now there are also ^{14}C-dated sites like Balakot, Damb Sadaat and Kot Diji with both Early Harappan and Harappan deposits. The three dates from Damb Sadaat II are consistent, with P-523 (4150 ± 75 BP) having the smallest error. This would suggest a date of about 4225 BP (uncalibrated) for the lower limit of the Harappa culture. The uppermost levels at Kot Diji (Period I) are dated to 4050 ± 140 BP. Six dates from the uppermost level of Mohenjodaro give a mean date of around 3950 BP. Radiocarbon dates in the main Indus region, therefore, show a spread of about 4250-3950 BP (uncalibrated), which agrees well with the archaeological evidence from Mesopotamia. Now there are many more dates from Harappa ranging between 2100-2400 BC (uncalibrated).

In the peripheral zone, Kalibangan in Rajasthan has been exhaustively dated (Agrawal & Kusumgar, 1974). Considering only those samples that were protected from more recent contamination by a good soil cover, we find that TF-607 and TF-608 date the beginning of the Harappa culture at that site around 4150 BP and that TF-143, TF-149, and TF-946 date the upper levels to around 3700 BP . Lothal provides a quite consistent set of dates giving a minimum spread of 4050-3750 BP or a maximum spread of 4150-3650 BP (obtained by adding one standard deviation on either side). In view of the thinness of the occupational depositional deposit at Lothal, compared to the other Harappan sites, we prefer the minimum time spread of around 4050-3750 BP. This bracket is further confirmed by the radiocarbon dates from Surkotada, also in Gujarat, where a bracket of 4150–3750 BP covers the total Harappan occupation and is in conformity with the dates from Rojdi. Amongst the recently excavated sites, Kuntasi and Padri, in Saurashtra, have given c. 1850 BC for the former and 2150 BC (both calibrated) for the latter. Kuntasi seems to be manufacturing site with six pottery kilns and also a bead-making furnace (Dhavalikar, 1993). Thus a comprehensive bracket of 4250-3650 BP (uncalibrated) covers both the nuclear (main Indus) and the peripheral Harappan time-spread. Shaffer (1992) and Possehl and Rissman (1992b) discuss the new evidence on the Harappan chronology in the third edition of *Chronologies in Old World Archaeology* (edited by Ehrich, 1992) and suggest 2800-2300 BC for the Kot Diji phase and 2500-2000 BC (both calibrated) for the Harappan phase.

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The End of the Harappans

The end of the Harappans is a polemical issue mainly because scholars have often emphasized single causes for the demise. Reality is always more complex. Besides the pressures exerted by the waves of invaders, there were perhaps a lot of environmental and palaeoclimatic causes that brought about the end.

There is no doubt however that the Indus did affect the Harappans. The ubiquitous raised platforms and massive bunds point to the severity of floods. The rising water-table could destabilize buildings, cause salinity, and render vast tracts infertile. The periodic changes in the course of the river could leave Mohenjodaro and other cities high and dry.

A variety of evidence from Rajasthan indicates wet and dry fluctuations (Agrawal, 1992). Increasing aridity may have aggravated the stress on the Harappan people, already exhausted by their incessant fight against floods and invaders. Besides, the mid-Holocene sea level was 5 m higher than at present, and then dropped as indicated by the fact that the Harappan ports of Sutkagendor, Lothal, etc., are inland today. At Amri, in the Early Harappan period, 90 percent of the molluscs were marine, but riverine species tended to increase with the advent of the mature Harappans, attaining a parity with the marine species by the end of the Harappan period. The Aryans also have been accused of giving the *coup de grace* to the Harappans. On the other hand, Rao (1973) equates the Indus civilization itself with the Aryans and is supported by Allchin and Allchin (1968). There is a consensus, however, that the Indus civilization is non-Aryan (Agrawal, 1966).

By about 1700 BC, the Harappa culture had started its transformation into the later cultures. Thus there were several causes of the decline and disappearance of the Harappans.

Before we discuss the metal technology of the Harappans, I would like to draw attention to some recent publications which summarize the latest Harappan evidence. An American team has been working at Harappa for a number of years now and in their new report, *Harappa Excavations 1986-1990*, multidisciplinary aspects of fauna, flora, soils, technology, and ceramics have been brought out using modern scientific techniques (Meadow, 1991). V.N. Misra (1992) edited a special volume of *The Eastern Anthropologist* (Vol. 45, 1&2, 1992) in which articles on irrigation technology and on biological anthropology are of special importance. G.L. Possehl has brought out two very important volumes: *Harappan Civilization* (revised edition, 1993) and *South Asian Archaeology Studies* (1992a). For those interested in more specialized and recent studies on the Harappa culture, these volumes will prove very useful.

Metal Technology of the Harappans

We should begin with considering the copper minerals the Harappans might have exploited for their artifacts. The representative Indian copper minerals are chalcopyrite ($CuS. Fe_2 S_3$), (b) chalcocite (Cu_2S), (c) malachite ($CuCo_3 Cu (OH_2)$, and (d) azurite ($2CuCo_3 Cu(OH)_2$). The Khetri copper belt in Rajasthan is 80 km long and in Bihar, the Singhbhum belt is of 130 km length. The important deposits are in Guntur, Arcot and Kumaon (Brown and Dey, 1955; Agrawal, 1971). Shah Maksud and Kalih Zeri (Baluchistan) may also have been used (Sana Ullah, 1931).

In the early Harappan levels, copper is generally meagre. The Early Harappan levels of Kalibangan, for example, yielded three artifacts, including a *parasu* (hatchet), similar to the Khurdi find. A much richer repertoire of knives, bangles, and axes has been reported from Nal.

The abundance of the Harappan copper artifacts is striking, although they continued to use chert blades (Fig. 11). The main types are flat celts, knives, arrowheads, spearheads, chisels, razors, fishhooks, saws, drills (Fig. 12,13), etc., besides the vessels and figurines. The Harappans used metal lavishly for vessels (Fig. 14). Most of them seem to have been made in two parts, the bottom and the top, and then joined together. They used sinking, raising and

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lapping and grinding etc., for joining metal, and also the running on and rivetting techniques. They employed open and closed casting, slow cooling, annealing and cold work (Agrawal, 1971; 1982). Small animal and female figurines were cast using the *cire perdue* (lost wax) process. The Harappan moulds are neither as ornate as the Chinese nor as intricate as the Mesopotamian specimens. The Harappans were the first to invent tubular drills, true saws, and needles with eyes at the pointed ends—these were re-invented in the West only in Roman times!

Alloying

Copper is not a hard metal, but can be made harder through beating (cold work). Excessive cold work, however, makes the edge brittle and it then requires heating (annealing) to make it ductile again. When copper is mixed with arsenic or tin it increases its hardness considerably. Copper should be alloyed with arsenic upto 5 percent and with tin upto 8-12 percent for maximal ductility and hardness. Only 23 percent Harappan artifacts were alloyed with tin, 12 percent with arsenic, 8 percent with lead (Agrawal, 1971). It is worth noting that the Harappans used both tin and arsenic; the Copper Hoards culture used exclusively arsenic alloying; and only tin alloying was used by the Chalcolithic cultures.

Though a large number of ancient copper workings have been radiocarbon dated (Agrawal et al., 1976) none of the dates so far is older then 3150 BP (uncalibrated). If we compare the trace impurity patterns between ores and artifacts, in both the Khetri (Rajasthan) ores and the Harappan artifacts, gold is absent, but a number of other trace elements (silver, iron, arsenic, antimony, lead, bismuth, tin, nickel, zinc, manganese, cobalt, aluminum, molybdenum, titanium, magnesium and vanadium) are present, thus suggesting the use of the Khetri ores by the Harappans. Geographically also, the Khetri mines of Rajasthan are the likely sources of the Harappan copper.

CHALCOLITHIC CULTURES

The Chalcolithic cultures used both stone and copper artifacts, but metal was rare. The cultures were non-urban. The non- Harappan cultures of the second millennium BC are included in this category. During the second millennium BC, the rest of the subcontinent was occupied either by Neolithic cultures, or by the Indus or Indus-related cultures. The main cultures discussed below are the Banas, the Kayatha, the Malwa, and the Jorwe cultures (Fig. 15) (Sankalia, 1958; 1969; 1971; 1974).

Banas Culture

More than fifty Banas culture sites are known from the valleys of the River Banas and Berach in southeastern Rajasthan. The excavated sites are Ahar and Gilund in Rajasthan and Kayatha in Madhya Pradesh. The available ^{14}C dates (uncorrected) suggest a bracket of about 3950-3350 BP for this culture (Agrawal and Kusumgar, 1974).

Ahar was anciently known as Tambavati (a city of copper), indicating its association with copper mines. The site has been divided into two periods (I and II), each further subdivided into three phases (*a, b* and *c*) (Sankalia et al. 1969). The Banasians cultivated *jawari* (a millet) and long-grained rice in Period II. It appears that food included turtle, fish, goat, sheep, deer, pig and cattle. At Ahar, only copper was used and no stone blades though the Banas culture had a developed blade industry at Gilund, only 80 km away, and also at Kayatha in Madhya Pradesh. Ahar yielded only five copper axes, one knife blade, one sheet, a bangle, and two rings. The Banas culture has seven main ceramic styles which Sankalia (1974) thought was due to ethnic diversity. The Black-and-Red Ware, externally painted in white, was the hallmark of

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this culture. A large number of terracotta bulls were discovered at Kayatha, though only few from Ahar (Figs. 16, 17, 18). Sankalia cites parallelism between the Banasian animal handles, vessels with appliqué, and punctured decoration with the Iranian sites. Some pottery forms of Ahar, for example, the animal-headed handles and the hollow-stemmed bowl in Grey Ware (Fig. 19), do recall similar types of Shah Tepe and Geoy Tepe and Hissar. So it would not be quite strange if some folk movement from Western Asia, starting in about 2000 BC had reached south-eastern Rajasthan (Sankalia et al., 1969).

Kayatha Culture

The fertile Malwa region is drained by the Narbada and its effluents, the Tapti and the Mahi, which debauch into the Arabian Sea. On the other hand, the rivers Chambal and Betwa also drain this tract but join the river Yamuna towards the north. The Malwa region has an annual rainfall of about 105 cm. And nights are cool even during the summer. The Chalcolithic habitations seem to be confined to the narrow, alluvial tracts of the rivers, as the poor copper implements were not adequate to plough the sticky black soil. This ecological constraint perhaps did not allow any surplus food production. This could be the reason why the Chalcolithic cultures never developed into urbanism, despite their copper technology.

The credit for discovering the Kayatha culture goes to Wakankar. Kayatha, the site after which the culture is named, is located on the River Kalisindh, a tributary of the Chambal. It is the earliest Chalcolithic culture in Central India and is radiocarbon dated (uncorrected) between 3950 and 3750 BC. Out of the approximately forty known sites only Kayatha has been excavated (Ansari and Dhavalikar, 1975).

The predominant Kayatha ceramic variety is a thick, sturdy, brown slipped ware painted in violet or deep red made of a fine, pinkish, well-levigated clay. Decorative motifs are generally linear and painted on the rim. The main pottery shapes are bowls, basins, globular jars with concave necks, and storage jars. The fabrics and surface treatment of the Early Harappan Sothi and the Kayatha wares show striking resemblances (Ansari and Dhavalikar, 1975).

The fact that 28 copper bangles were recovered from a single pot shows that the Kayathans were rich in copper. The two copper axes, cast in a closed mould, and with a sharp cutting edge and a lenticular section, are the finest examples in the Bronze Age of India. The term Chalcolithic implies that these cultures used both copper and stone. Even the Harappans, despite the abundance of copper artifacts, used long chert blades. The Chalcolithic blades used by the Kayathans, the Banasians, and the Navadatolians, however, are shorter than the Harappan examples, perhaps because only smaller sized chalcedony nodules were available. The Kayathan blade industry includes lunettes, 'penknives', and parallel-sided blades, made of chalcedony locally available in the form of veins. Semiprecious stones like carnelian, agate and steatite were used for ornaments. Four thousand threaded microbeads of steatite were found in a pot. Two necklaces of long barrel, short bicone, and oblate beads of carnelian and agate were discovered in a ceramic vessel; a similar find was made at Mohenjodaro also.

Malwa Culture

The Malwa Ware (a buff or orange-slipped pottery painted in black), copper or stone artifacts and small village settlements of wattle-and-daub huts seem to define the Malwa culture (radiocarbon dated to 3650-3350 BP; uncalibrated). Eran, Nagda, and Navadatoli are the excavated sites of the Malwa Culture in Madhya Pradesh, and Inamgaon in Maharashtra.

The best known site of the culture is Navadatoli (Sankalia et al., 1971). Navadatoli locally means village of the boatmen. The main site is situated on the southern bank of the river Narbada; and its twin site Maheshwar, on the opposite bank. It was a well-chosen location with a beautiful panorama of the tall Vindhyas in the north, the low Satpuda hills in the south, and

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a wide expanse of the Narbada with its extensive alluvial beds on both sides. The Chalcolithic technology could adequately deal with only fresh alluvium, and not the black cotton soil.

The Chalcolithic Navadatoli shows four distinct phases. Phase I is marked by the Banasian type of Black-and-Red Ware; Phase II by the Cream-Slipped Ware; Phase III by the Black on Red Ware; and Phase IV by a coarse red ware in association with the Lustrous Red Ware, akin to that of the post-Harappan Gujarat cultures. However, the Malwa Ware (Fig. 20) occurs throughout the occupation. Navadatoli has the richest repertory of ceramic designs of all the Chalcolithic cultures, including the Harappans. The Malwa Ware, which constitutes one-third of all the pottery recovered at the site, was painted in black or brown over a buff or orange slip, and has a thick fabric due to the use of chopped husk. Some ceramic motifs are probably religious in character, e.g., the appliqué figurines of what appear to be a female worshipper and a lizard flanking a shrine on a big jar; another motif depicts a shrine with a tortoise.

The food consisted of wheat (*Triticum vulgare compactum*), barley, rice (*Oryza saativa L.*), black gram, green gram, lentil (*Lens culinaris Medicus*), grass pea (*Lathyrus sativus L.*), linseed, ber (*zizyphus jujuba Lamk*), and amla (*Phyllanthus embelia*). Beef, venison and pork were part of the non-vegetarian diet.

Stone tools of a milky chalcedony were made using the crested ridge technique for obtaining blades. Of the 23,000 artifacts recovered from Navadatoli, 'penknife', blunted backed, serrated and parallel-sided blades, trapezes, and lunettes were the main types.

The copper artifacts comprise flat cells with convex cutting edges, arrowheads, spear-heads, chisels, bangles, rings and a mid-ribbed sword.

Many similarities between the Malwa culture and the West Asian cultures have been pointed out. Channelled spouts have close parallels with those of Tepe Sialk (about 1800 BC), and goblets with those of Sialk, Giyan, and Hissar II (around 3000 BC). Even the mother goddess cult has been traced to Western Asia (Sankalia, 1974). Sankalia did not think that the Malwa people were actual immigrants, but were acquainted with the way of life of Iran and Western Asia, though Dhavalikar (1979, 1988) associates them with the Vedic Aryans. The Malwa culture, however, seems to have arrived at Navadatoli already fully developed.

The best known Malwa Culture site of Maharashtra is Inamgaon which has been scientifically excavated and has yielded more information about the Chalcolithic way of life than any other site in India. It is located on a terrace of the river Ghod, 80 km east of Poona. Dhavalikar (1977) divides the deposits into the Malwa culture (period I), the Early Jorwe culture (Period II), and the Late Jorwe (Period III).

In addition to wattle and daub huts, Inamgaon has some unique pit dwellings. The pits are about 2 m wide and 50 cm deep, and usually nine poles were fixed along the periphery to support the roof. One of the biggest houses had a pit (with steps) 3 m in diameter and 1.2 m deep. A twin urn burial was discovered underneath the floor of one of the pit houses. A large (6.6 by 4.4 m), rectangular, wattle-and-daub house had a circular platform in one corner, perhaps for storage bins. Other finds were a rectangular *chulah* (hearth); a storage jar; four clay bowls; a variety of other pots and pans; bone points; blades; beads; and faunal remains. The plant remains include *Hordeum vulgare, Lens esculenta, Dolichos biflorus*. There was room for only four or five people in the house, because of this cluttering.

Massive copper animal figures of a rhinoceros, an elephant, a buffalo, and a bull chariot driven by a man, all mounted on wheeled platforms, were accidentally discovered near Daimabad and have been ascribed by some to the Chalcolithic phase, or to the late Harappan period. Each object, however, weighs several kilograms and to use such a quantity of metal for non-utilitarian artifacts seems unlikely for a Chalcolithic phase.

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Jorwe Culture

The home of the Jorwe culture is Maharashtra which comprises the Deccan plateau. Only the river valleys have open plains with rich soil cover with an annual rainfall in the range of 50-100 cm, but droughts are frequent. The vegetation is xerophytic, e.g., acacia, tamarind, and caparis. The main Jorwe culture sites are located in the Pravara-Godavari basins. Smaller Jorwe sites seem to be concentrated around major centres. The former usually have only a few huts and an area of 2-3 ha. whereas a major centre like Prakash in the Tapti Valley or Inamgaon in the Bhima Valley and Daimabad in the Godavari Basin may cover 20 ha each. Inamgaon, Theur, Songaon, and Chandoli in Pune District, Bahal in Jalgaon District, Prakash in Dhulia District, and Jorwe and Nevasa in Ahmednagar District are the main excavated sites (Dhavalikar, 1979).

They cultivated barley, wheat, lentil (*Lens esculenta*), kulith (*Dolichos biflorus*), grass pea (*Lathyrus sativus L.*), and occasionally rice. Rice could have been grown only through irrigation. Besides, *ber* (*Zizyphus jujuba*), *jamun* (*Syzigium cumini L.*), and *beheda* (*Terminalia belerica Roxb)* were also grown. They seem to have developed irrigation technology as indicated by the massive embankment (240m long, 2.2m wide and perhaps equally high) which was probably used to divert flood water through a 200m long, 4 m wide and 3.5 m deep channel. This large channel seems to have been used for the storage of water for irrigating the fields. The embankment may indicate a higher rainfall and frequent floods in the early Jorwe period. The cooking wares were: earthen pans to bake chapatis, large saddle querns to make wheat and barley flour.

Domesticated animals include dog, elephant, horse, pig, cattle, goat and camel. Black buck (*Antelope cervicra*), *nilgai* (*Boselaphus tragocamelus*), wild buffalo (*Babalus bubalis L.*), *chital* (*Axis axis*), sambhar (*Cervus unicolour*), and *barasingha* (*Cervus duvuceli Cuvier*) are the main wild fauna.

The pottery consists mainly of the Jorwe Ware (Figs. 21, 22) which has a fine fabric and is well baked. The surface is red or orange matte painted with geometric designs in black. The pottery types are: spouted jar with a flaring mouth, the carinated bowl, and the high-necked jar with a globular profile. A few pots are theriomorphic. The heavy-duty pots, like storage jars, platters, dough plates, and even lamps, were handmade in coarse red or gray ware.

A big kiln has also been found. It is built on stone foundations in the form of a huge trough of clay about 1.7m in diameter. It had a number of oval clay cushions with holes which were placed over the fire chamber for the hot gases to escape. Air ducts radiated from the centre of the kiln.

Ornamental beads were made from a variety of material: agate, carnelian, jasper, chalcedony, gold, copper, and ivory. Copper anklets and gold ear ornaments have also been reported. Gold-working is indicated by a pair of tongs and a crucible. Copper axes, chisels, knives, fishhooks, beads, and bangles and a smelting kiln at Inamgaon indicate local copper working.

They buried their dead with the head facing north in extended positions with the feet chopped off below the ankles, perhaps to immobilize their ghosts. Children were buried in coarse handmade urns (Fig. 23). Spouted jars and bowls in the graves suggest that the dead were provided with food and drink for the after-life. They also found a four-legged, unbaked urn burial containing a sitting adult skeleton. One of the sides of the urn is shaped like a female belly and the skeleton was in an embryonic position. From the largest house of the Early Jorwe period was recovered another four-legged urn, with funerary jars and a bowl but no skeletal remains. Was it the chief's burial?

Quite a few terracotta female figurines, with pendulous breasts, with or without heads, both baked and unbaked, are reported from Nevasa, Inamgaon, and elsewhere. One of the figurines was found in a clay receptacle (Fig. 24) from the elite area of Inamgaon.

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At Inamgaon, the craftsmen's quarters were located to the left of the entrance of the settlement, on its western periphery, a tradition which is followed even today in the central Maharashtra villages (Dhavalikar, 1988). At Inamgaon one can see the products of potters, ivory-carvers, goldsmiths, and lime-makers (lime was used as an insecticide). As is the practice even today, pit silos were dug into the house floors to store coarse grains like barley and kulith. Perhaps the craftsmen were paid in kind for their services, hence the need for storage space. Even today the *bulutedars* (cobbler, potter, smith, carpenter, etc.) are paid in the form of coarse grains at the time of the harvest.

The presence of the largest houses, with five rooms in an area of 25 by 10 m, at the centre of the Inamgaon settlement suggests that it was the elite quarter. The 1.83 m tall male skeleton, with his ankles and feet intact, was found in the largest house. He could have been the Chief as indicated by the fact that his legs were not mutilated and he lived in the largest house. Only in the elite central area were found the four-legged jars for storage; these were perhaps for wheat, which must be stored above ground. The granary is also located in the central part of settlement as perhaps taxes may have been paid to the chief in kind. The granary (10.5 by 9 m) had both pit silos and round mud platforms for storage bins.

By the close of the first millennium BC, severe aridity in Maharashtra may have resulted in large-scale desertion of sites in the northern Deccan plateau and migration to the Krishna and Kaveri valleys in the south. In the Late Jorwe period at Inamgaon, the decline and degeneration seem to be reflected in coarser paintings and pottery, and smaller rounded huts in contrast to the large rectangular houses of the previous period. The megalithic black-and-red ware brings the late Jorwe culture to the threshold of the early historical period. On the basis of the radiocarbon dates (uncalibrated), the Jorwe culture has been assigned a time bracket of about 3350-3050 BP.

Chalcolithic Metal Technology

Stone artifacts constituted the main tool assemblage of the Chalcolithic cultures and not the copper tools1(Figs. 27, 28). About 17 percent of the Chalcolithic artifacts show tin alloying. But there are variations : at Ahar, only pure copper was used; a Jorwe axe has only 1.7 percent tin; a Nevasa chisel has 2.7 percent tin; at Navadatoli, the range of tin alloying is 3-5 percent; and in an axe from Somnath, 22.8 percent tin, the highest tin content, was recorded. Unlike the Harappan and Copper Hoard cultures, the Chalcolithic groups did not use arsenic for alloying. About 20 percent of the artifacts contained lead to improve fusibility.

Only a few metallographic analyses on the Chalcolithic artifacts are available (Agrawal, 1982). The equiaxial grains and the absence of coring on a Chandoli axe indicate a slow cooling of the cast, yet the puckered surface shows that green poling was not used. Several artifacts indicate the evidence of cold work and annealing. Hegde finds a close similarity between the impurity patters of the Chalcolithic artifacts and the Khetri copper minerals thus indicating the possibility of their use by the Chalcolithic cultures.

As mentioned above, the most beautiful examples of the Chalcolithic craft are the cast axes from Kayatha. The main artifacts are beads, nails, rods, wires, fishhooks, rings, flatcelts, tongs (Figs. 25,26) and daggers. Though the Chandoli dagger has been compared with the antennae-hilted sword from Fatehgarh, there are very important technological differences between the two. The total length-to-blade ratio in the Chandoli dagger is only 1.6 compared to 5 in the Fatehgarh example. The Chandoli (Fig. 27) dagger tang was cut with a chisel producing an incipient antenna but it does not stand any comparison with the 10-15 cm long Copper Hoard antennae.

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THE COPPER HOARDS CULTURE

There is some circumstantial evidence to associate the Copper Hoard Culture with the Ochre Coloured Pottery (OCP). We would, however, argue that neither the OCP nor perhaps the Copper Hoards is one unified culture.

The first report of the OCP came from the pre-Painted-Grey-Ware levels of Hastinapur. The OCP potsherds rubbed off an ochreous colour, hence the name, though this may have been a purely local effect. The OCP originally was painted black and also had a slip.

The Copper Hoard artifacts were generally found in hoards, mainly from Uttar Pradesh, Bihar and Madhya Pradesh. As most of the artifacts were chance finds, there was not much archaeological evidence associated with the assemblage. This led to the clubbing of finds from such far-flung sites as Shalozan in north-western Pakistan, Bhagrapir in Orissa, and Kallur in the south under the label of the Copper Hoard culture. This amorphous collection of artifacts included: rings, a variety of celts, trunnion axes, anthropomorphs, harpoons, swords, double-edged and socketed axes, and so on (Heine Geldern, 1936). Such an odd assortment of tools gave rise to a plethora of hypotheses till Lal (1951) brought about some order. He showed that a number of types (such as the Fort Monroe sword, axe-adze, socketed axes, and trunnion axes) were confined to the north-west (now Pakistan) and never occurred in the Gangetic doab. On the other hand, the other types (Figs. 28-31), such as antennae-hilted swords, anthropomorphs, harpoons, and bracelets, were confined mainly to the Gangetic valley. He also showed the significant technological difference between the Koban examples and the antennae swords (Lal, 1951), which were bracketed by Heine Geldern to prove his Aryan equation. The distinctive types that can be included under the Copper Hoards category are: flat and shouldered celts, antennae swords, harpoons, anthropomorphs, hooked swords, and double-edged axes. The last type has been reported from Bhagrapir (Orissa). Although they are up to 40 cm wide, the fact that they are less than a mm thick precludes their use as tools. Even their association with the main Copper Hoard culture is doubtful. The hooked swords seem to have parallels elsewhere, but a closer examination reveals that the apparently similar Harappan examples have a hole for hafting and not a hook. And in the so-called similar Chalcolithic example from Navadatoli, there is hardly any median ridge or hook. The typical hooked swords, on the other hand, have been found in association with such distinctive Copper Hoards types as anthropomorphs, antennae swords, and harpoons from the sites in Uttar Pradesh (e.g., Bahadurabad, Sarthauli, Fatehgarh, Niori).

We examined several anthropomorph specimens and found that they invariably had : externally sharpened and incurved forearms, plain hind-limbs, and a thickened head. Therefore, we have proposed their possible use as missiles to kill birds : the sharp arms could cut the bird; the thick head could stun it; and the incurved arms could entangle and bring it down. Field experiments also showed that an anthropomorph could follow a trajectory not unlike that of a boomerang (Agrawal, 1969). Sankalia (1974) objected to this hypothesis on the ground that such a device would be too complicated for a primitive people. In reply we have to point out that the boomerang was also invented by primitive tribal people. We have also to examine here the fragmentary copper piece with a convex end and two broken side lugs (Fig. 32) from the Harappan levels of Lothal, which Rao (1973) compared with the anthropomorphs from the Doab; but if it had longer arms like those of the Copper Hoard examples it would not be mechanically feasible for it to break so near the body (Agrawal, 1971). It should also be emphasized that in its form the Lothal piece (Fig. 32) is unique in the whole range of the Harappan artifacts.

Harpoons are of two types : one cut from a thick sheet, and the other cast in a double mould. As depicted in a rock shelter scene, such harpoons could have been used either for killing fish or big game (Lal, 1951).

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The total length of the antennae sword types varies from 42 to 75 cm and the antennae projection on the hilt end are more than 10 cm in length. Such long antennae would be definite handicaps in their use as swords and therefore I have proposed that they could have been better used to kill wild game by fixing the swords upright in pits, with the antennae sitting in sites across green logs. When the game were stampeded into the pits, the swords would pierce them without buckling, as the green logs and branches would serve as shock absorbers. Of course at this stage this is only an hypothesis.

It is obvious that the essential repertory of the Copper Hoards consists only of the anthropomorphs, the harpoon, the hooked sword, and the antennae sword (Agrawal, 1971). These types were found together: for example at Bisauli, harpoons are associated; antennae swords and anthropomorphs were found together at Fatehgarh; and the hooked swords were associated with the other three types at Fatehgarh, Sarthauli, Bahadurabad, and Niori.

The Copper Hoards should be divided into two zones: the main Doab (Uttar Pradesh) and Bihar. The doab types are specialized tools: the anthropomorph, the antennae sword, the harpoon, and the hooked sword. The main eastern (Bihar) type is the barcelt; flat and shouldered celts are common to both zones. The barcelt is about 60 cm long with a bevelled edge and a thick body. The sturdiness and length of the barcelt suggests its use as a crowbar for digging copper ores, and the use marks on barcelt do indicate their use against hard surfaces. The barcelt is the only specialized type in the eastern group. No doab types have been discovered from Haryana or Rajasthan, except for a reported harpoon from Mitathal (Surajbhan, 1975). The *parasu* seems to be a type of this area and has been reported from Mitathal and Kurada in Rajasthan. The distribution of the Copper Hoard types is therefore mainly confined to Uttar Pradesh, Bihar and Madhya Pradesh. The Copper Hoards have an individuality of their own and were not influenced by either the Harappan or the Chalcolithic cultures, as also indicated by their exclusive arsenic alloying.

Copper Hoards Metal Technology

As most of the Copper Hoards have been found in caches, they give an impression of abundance of metal. At Gungeria, for example, 424 artifacts with a total weight of more than 400 kg were discovered. It will, however, be difficult to infer the real abundance of metal without a proper archaeological context.

The Copper Hoards artifacts were made both by hammering and cutting metal sheets, as well as by closed casting. A small percentage of the artifacts show lead alloying, probably for better fusibility. Slow cooling, cold work, and annealing is indicated by the metallographic examination of the artifacts.

Circumstantial evidence points to the use of Bihar mines, though the Kumaon ores cannot be ruled out as iron metallurgy itself goes back there to the beginning of the first millennium BC. Besides, some anthropomorphs have been reported from Kumaon (Bankot). The exclusive occurrence of barcelt in the eastern region probably indicates their use in mining.

Out of the 46 artifacts analysed by us, 50 percent show more than 1 percent arsenic, with none of the artifacts showing any tin, which indicates that the Copper Hoards' technological tradition is different from that of the other cultures. In the earliest phases, both in the Near and Middle East, only arsenic alloying was used (Eaton and McKerell, 1976); only in the Third Millennium BC does tin replace arsenic. There are no significant sources of arsenic in India, although small outcrops are known from Rajasthan, Kashmir, and Bihar. Nal in Pakistan, yielded lollingite ($FeAs_2$).

Exclusive arsenic alloying and characteristic tool-types indicate the possibility of the Copper Hoards being an autochthonous, and perhaps the oldest, metallurgical tradition in India.

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At this stage we can examine Figure 33. In this histogram we have plotted the percentage of artifacts against what metals they are alloyed with for different protohistoric cultures. About 23 percent of Harappan artifacts are alloyed with tin whereas only about 15 percent of Chalcolithic artifacts are alloyed with it. In the case of arsenic, however, almost 50 percent Copper Hoards artifacts are alloyed with it and only about 15 percent of Chalcolithic and only about 12 percent of Harappan artifacts. No Copper Hoard artifact is alloyed with tin and none of the Chalcolithic tools with arsenic. To me this shows relative isolation and lack of technological exchange amongst these cultures. It could also mean that these cultures had distinctive ethnic identities.

With some cist burials from Kumaon going back to 2600 BC, and the discovery of some Copper Hoard types from Kumaon, it is quite possible that the source of metal for the Copper Hoards could also be located in Kumaon. The Kumaon copper ores are known to contain arsenic also. With the discovery of very ancient copper and arsenic mines in Kumaon it has become distinctly possible to conclude that both early copper and early iron was being supplied from Kumaon (Agrawal et al., 1994).

We should also take note of some remarkable discoveries made recently in Rajasthan (Agrawala, 1979). Sixty copper flat celts and some arrowheads were discovered from Ganeshwar, in Sikar District of Rajasthan. We should note that the arrowheads are of the Harappan type and also the fact that the site is only 60 km from the rich Khetri belt. Agrawala also reports a Kurada hoard from Nagaur District of Rajasthan which originally consisted of 103 artifacts, but only ten now remain in the Jodhpur museum. However, none of the types is typical of the Copper Hoards culture. The channel-spouted bowl has affinities with the Malwa channel-spout and the hatchets look similar to the Kalibangan Harappan specimens.

There seems to be a distinct possibility that some of these sites served as factory centres for the Harappan and Early-Harappan towns, but in no way can we relate them with the Copper Hoards.

Conclusions

We thus see that the first Indian urbanization began in the Third Millennium BC, aided and abetted by the mid-Holocene climatic amelioration, copper technology and abundant supply of metal minerals, irrigation technology, agricultural surplus, internal and external trade, the vast alluvial plains of the Indus and the Sarasvati rivers. In the second millennium BC, we find a number of copper and stone using cultures, mostly non-urban except the Harappa culture, partly contemporaneous, but in different ecological niches. Despite the copper technology, neither the Chalcolithic nor the Copper Hoards cultures could usher in urbanization, mainly because of ecological constraints; in MP and Maharashtra they could not cultivate the black cotton soil and in UP the monsoonal forests and kankar-ridden soils with their meagre copper implements (Agrawal, 1992). The latter areas had to await the advent of iron to get colonized. There are significant differences in the respective copper technologies of these three main protohistoric cultures, which indicate basically lack of contact, despite part-contemporaneity. The question of ethnic equations is quite polemical and various Indo-Aryan waves have been identified with different cultures. Except with the use of modern genetic techniques (Cavalli-Sforza et al., 1993) these issues cannot be resolved and will remain in the realm of conjecture.

ACKNOWLEDGMENTS

I am grateful to Shashi Asthana, R.S. Bist, Dilip Chakrabarti, V.N. Misra, and Vibha Tripathi for discussions and help and the Archaeological Survey of India and Deccan College, Pune, for allowing the use of their illustrations.

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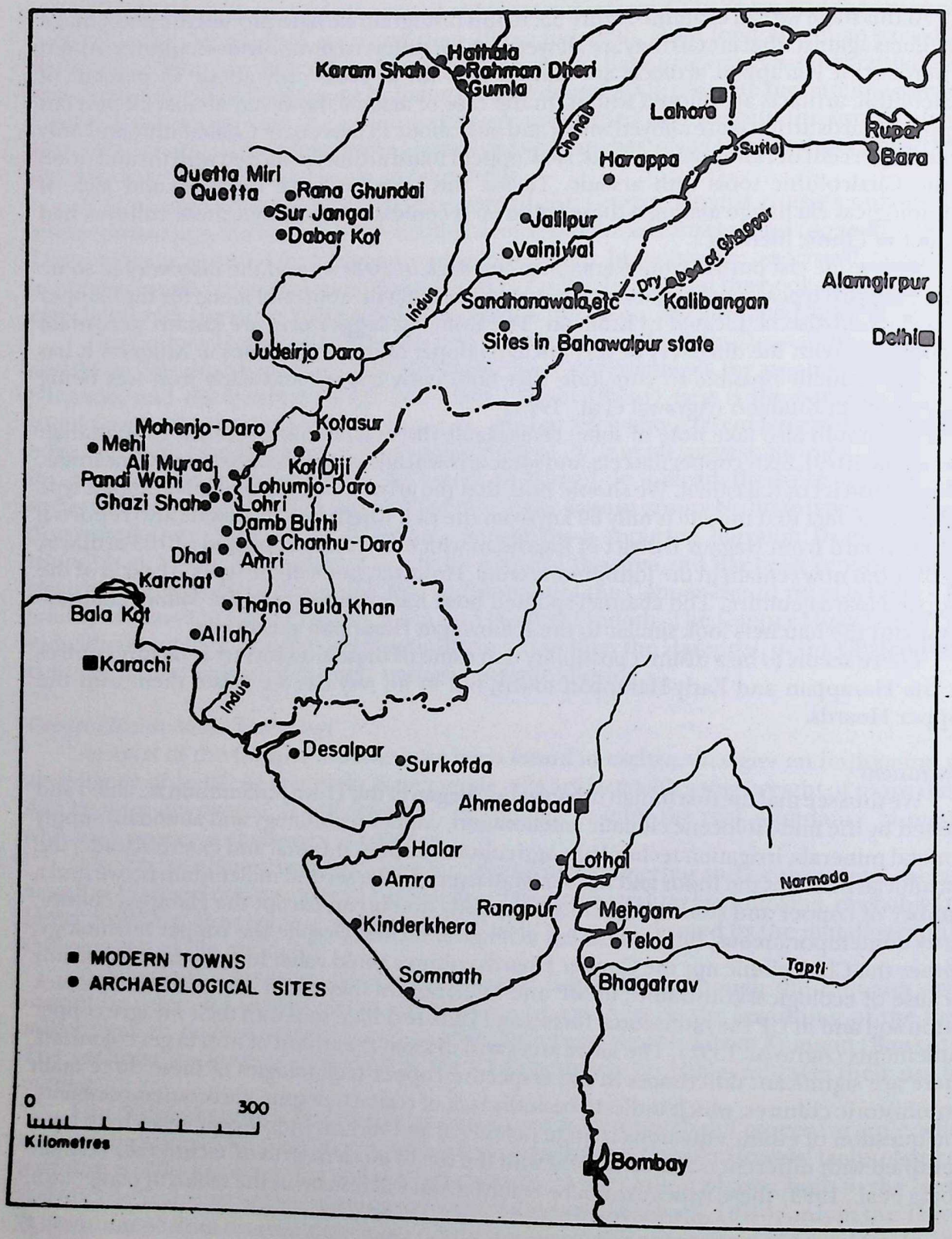

Fig. 1: Distribution map of the main Harappa culture sites.

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Fig. 2: A Harappan red ware jar with typical motifs of intersecting circles, pipal leaf, peacock etc., (courtesy ASI).

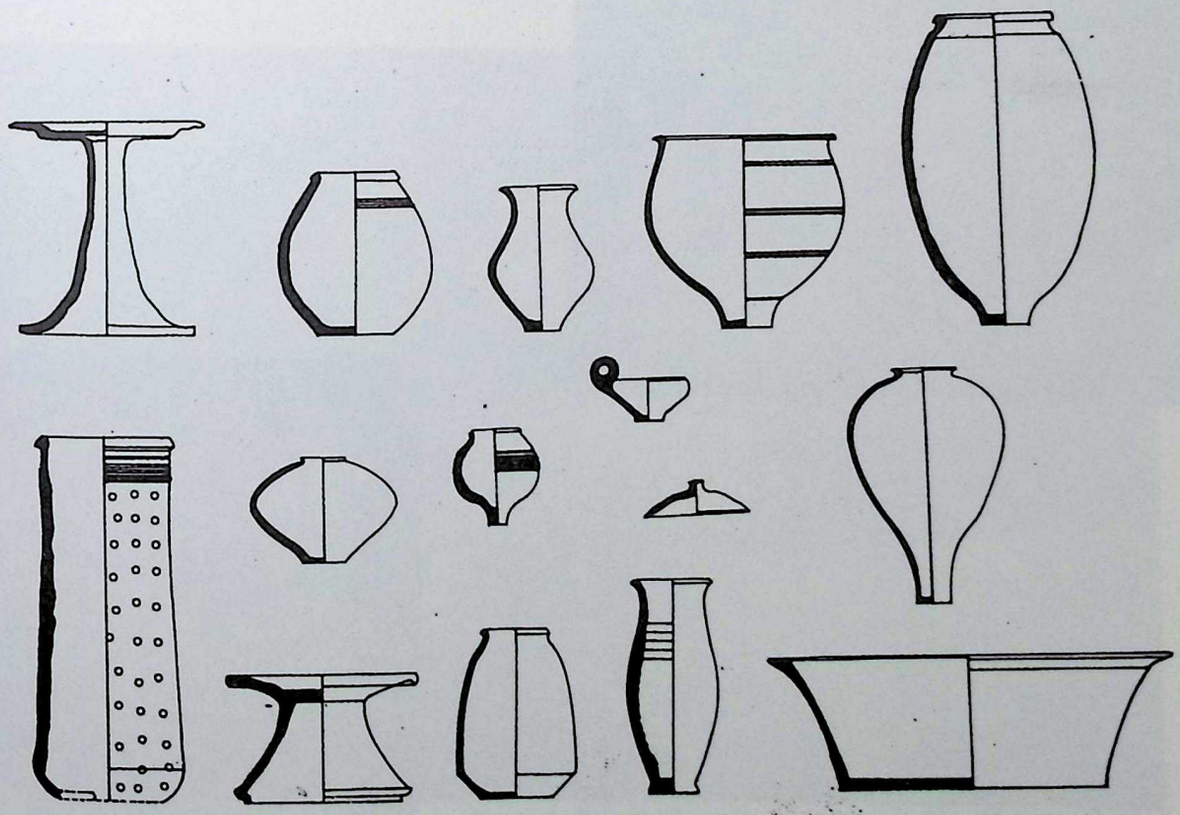

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Fig. 4: A female terracotta figurine from Mohenjodaro.

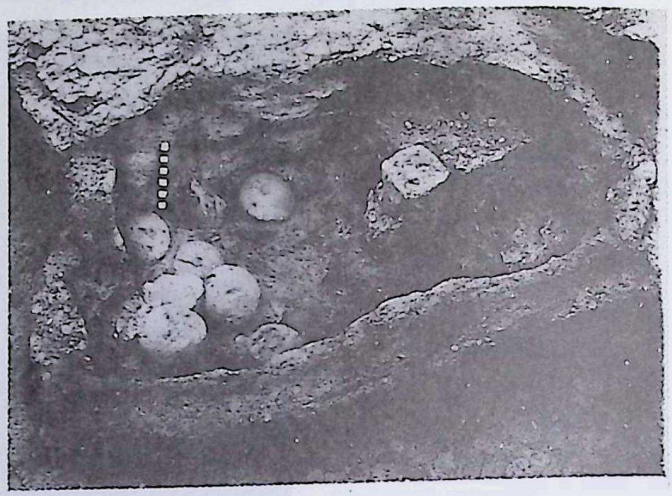

Fig. 5: A domestic fire altar with terracotta cakes from Kalibangan (courtesy ASI)

Fig. 6: A reconstruction of the Harappan town of Lothal with its wharf and port (courtesy ASI).

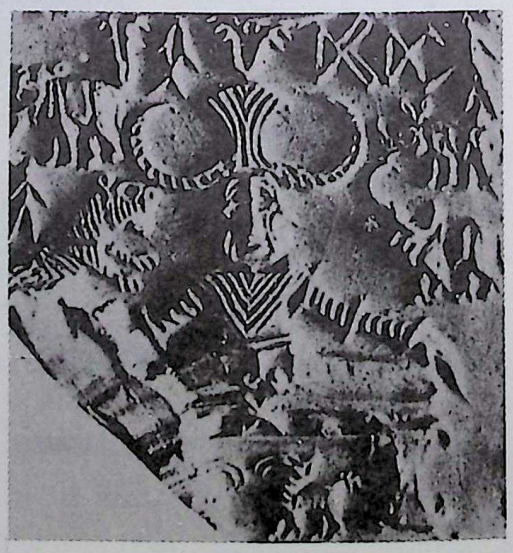

Fig. 7: A Harappan steatite seal impression of a horned deity identified with the latter-day god Śiva. Note the animals and the ithyphallic posture. (courtesy ASI)

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Fig. 8: A red ware large bin with the horned deity motif from Padri, a Harappan site of Saurashtra (courtesy Deccan College).

Fig. 9: A terracotta cake from Kalibangan showing a horned deity on the top (obverse) and a human carrying an animal for sacrifice (?) (reverse) (courtesy ASI).

Fig. 10: Kalibangan cemetery: a grave showing two modes of burial, the extended inhumation at top and the pottery deposit at the bottom (courtesy ASI).

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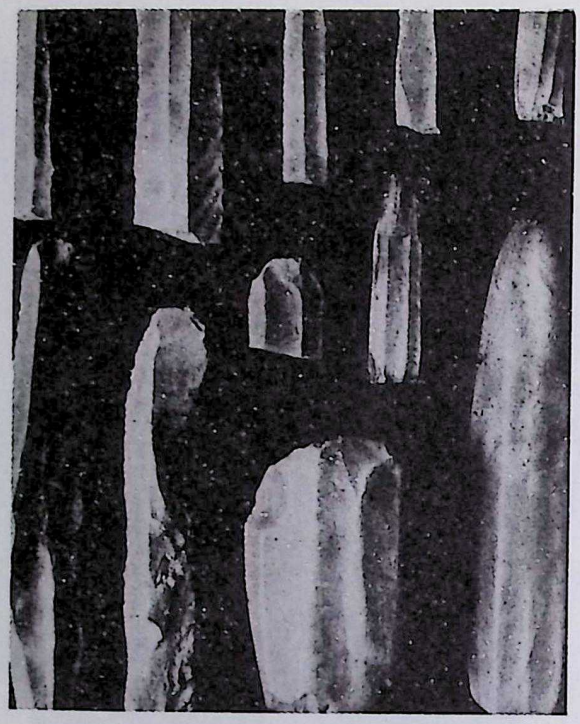

Fig. 11: Chert blades and cores from Mohenjodaro (courtesy ASI).

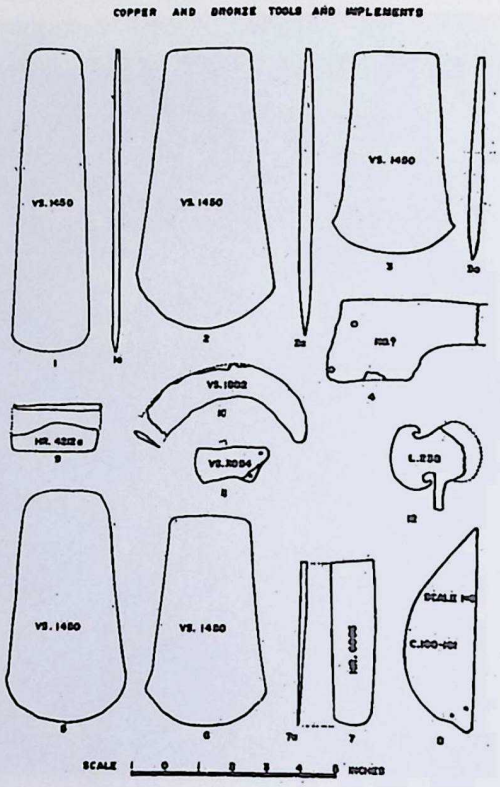

Fig. 12: Some typical Harappan copper artifacts.

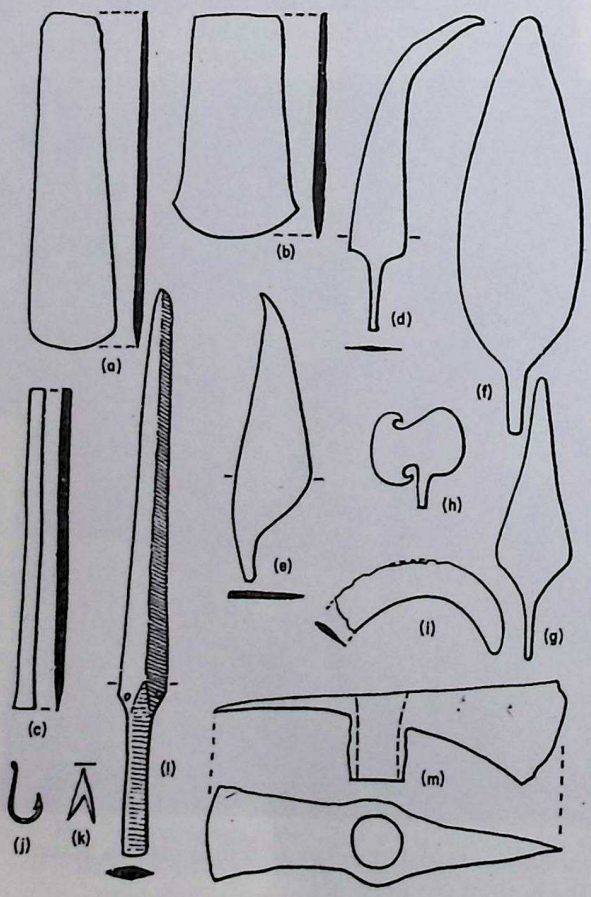

Fig. 13: Typical Harappan copper tool types from Mohenjodaro. The sword (1) measures about 40 cm in length. Socketed axes (m) are quite rare in the Indus civilization.

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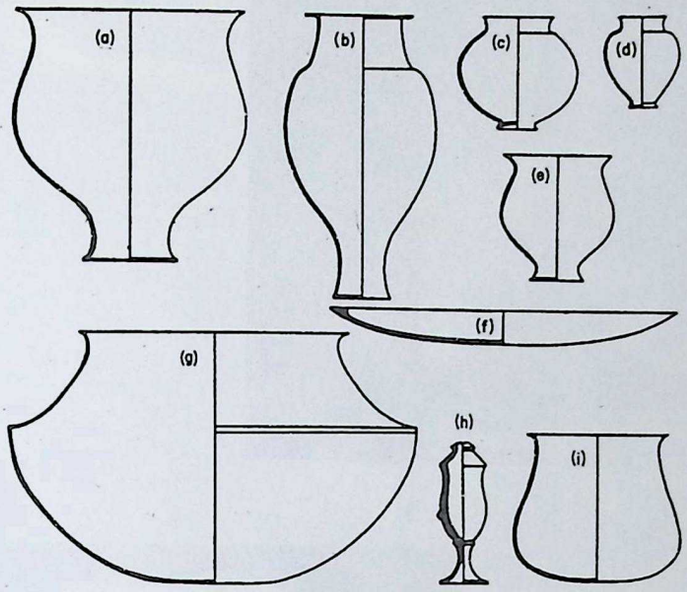

Fig. 14: Copper vessels from Mohenjodaro; jar (b) is about 18 cm tall.

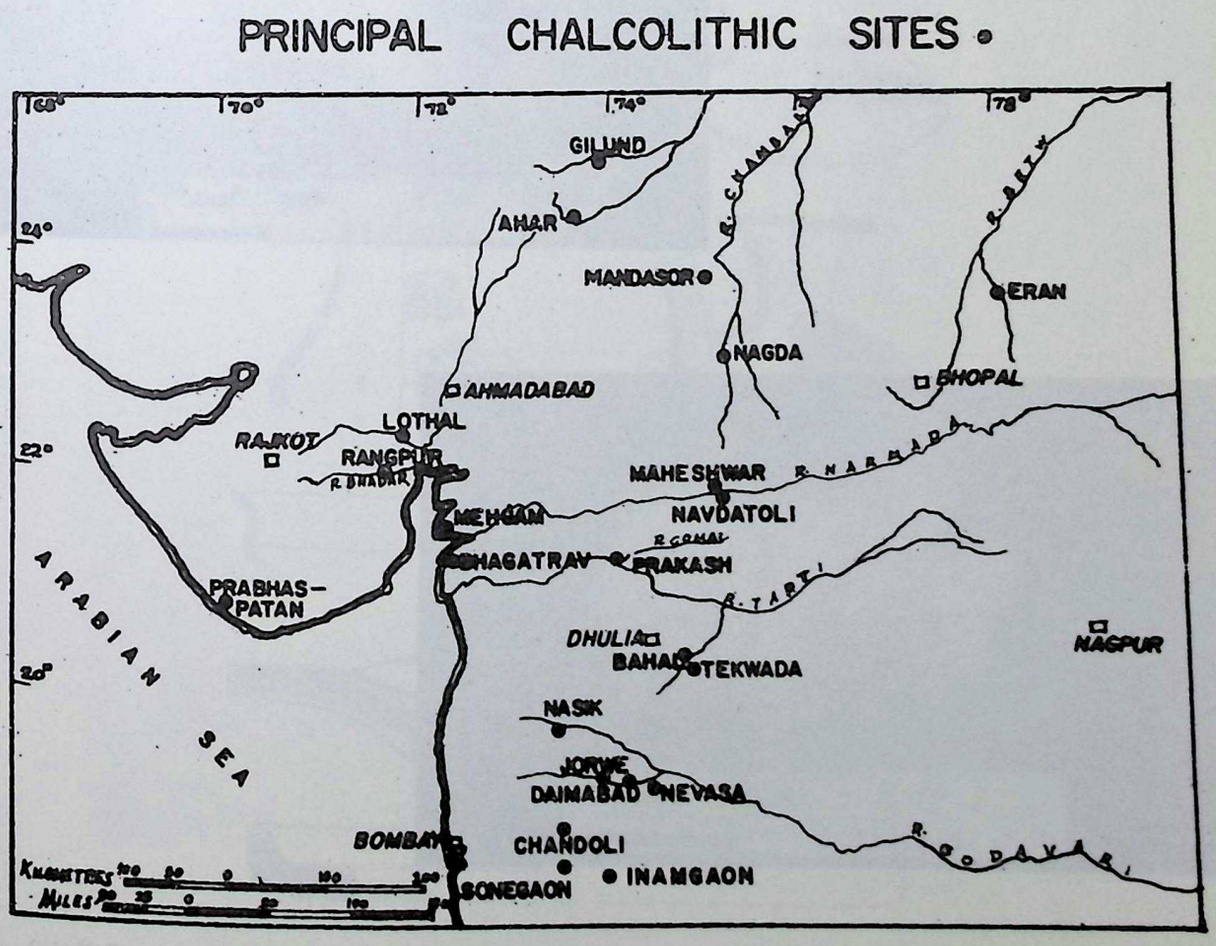

Fig. 15: Distribution map of the main Chalcolithic sites.

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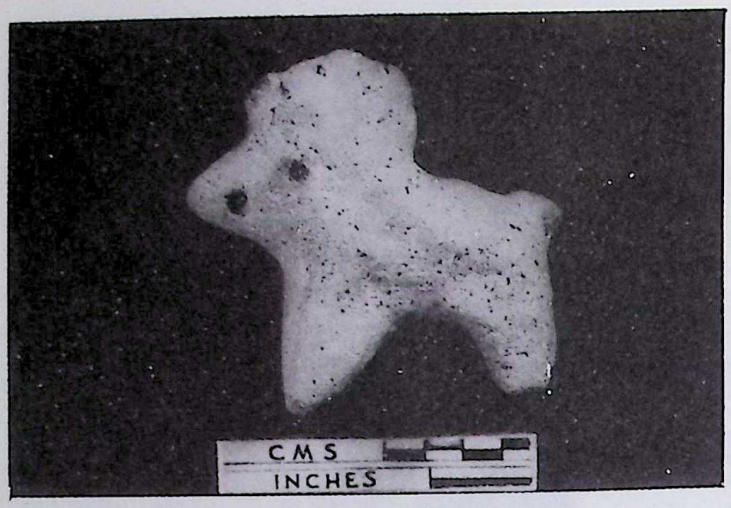

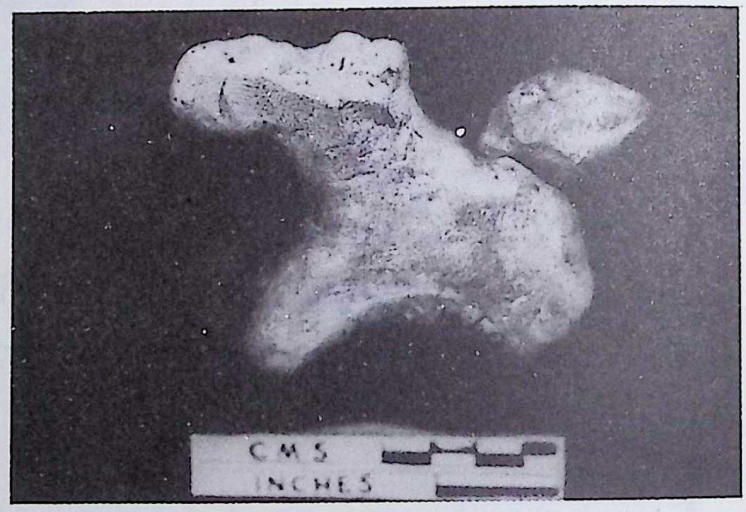

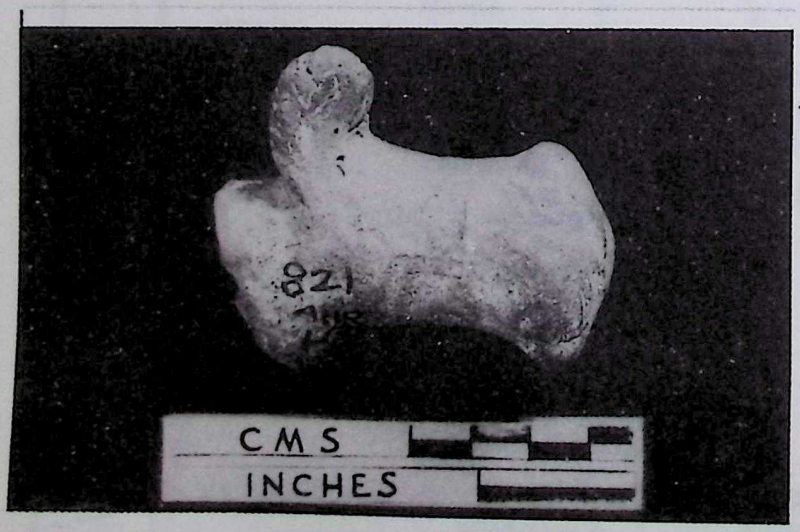

Fig. 16-18: Terracotta bulls from Ahar, a Banas Culture site of Rajasthan (courtesy Deccan College).

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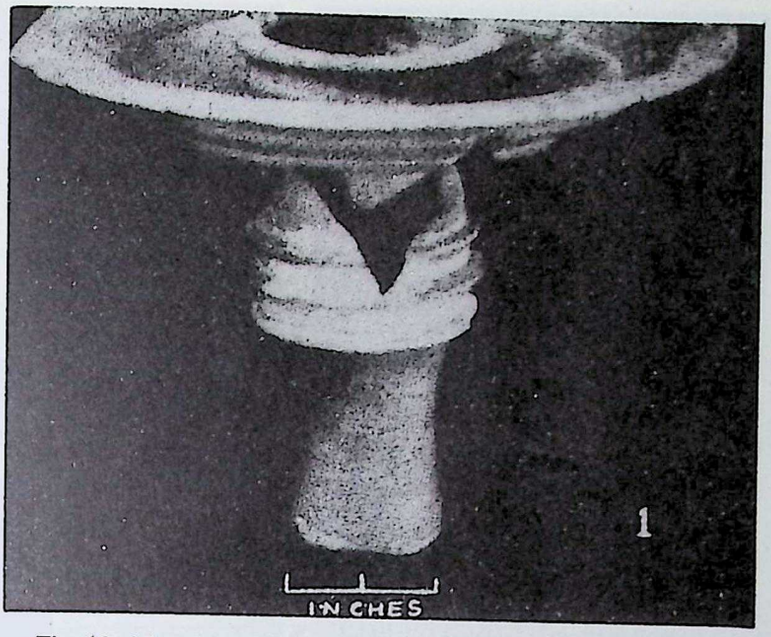

Fig. 19: A bowl-cum-dish-on-stand from Ahar (Banas Culture) (courtesy Deccan College).

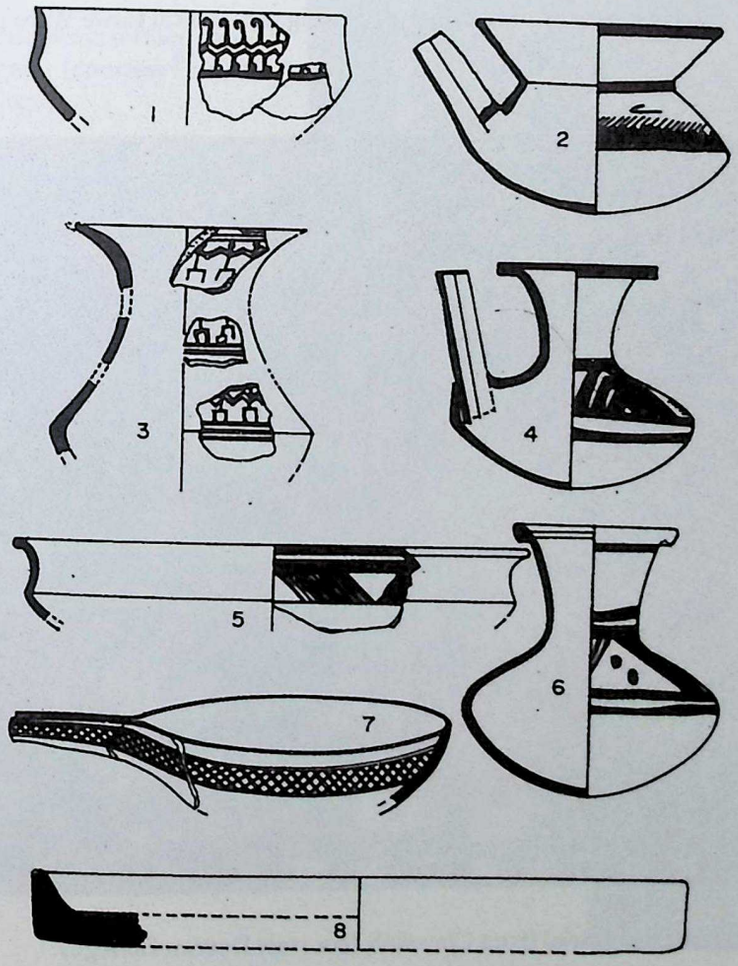

Fig. 20: Black painted red ware Nos. 1,3,5,7 and 8 belong to the Malwa Culture, the rest to the Jorwe Culture.

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Fig. 21: A Jorwe Ware spouted pot from Nevasa (courtesy Deccan College).

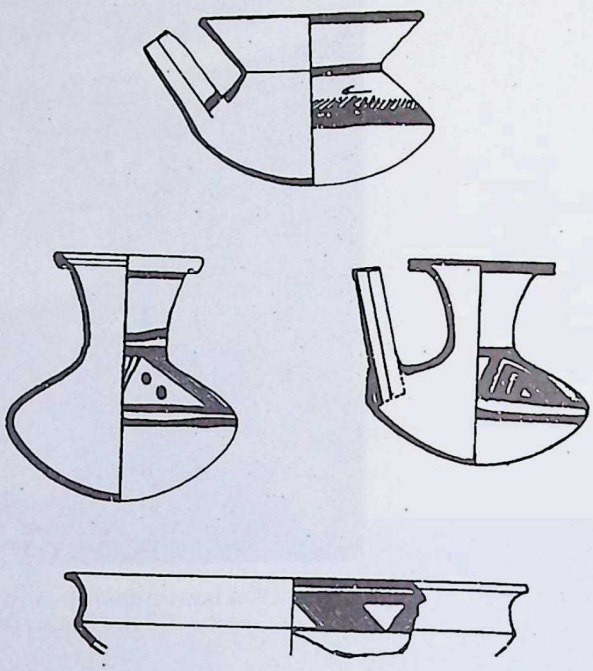

Fig. 22: Typical Jorwe Ware pottery shapes.

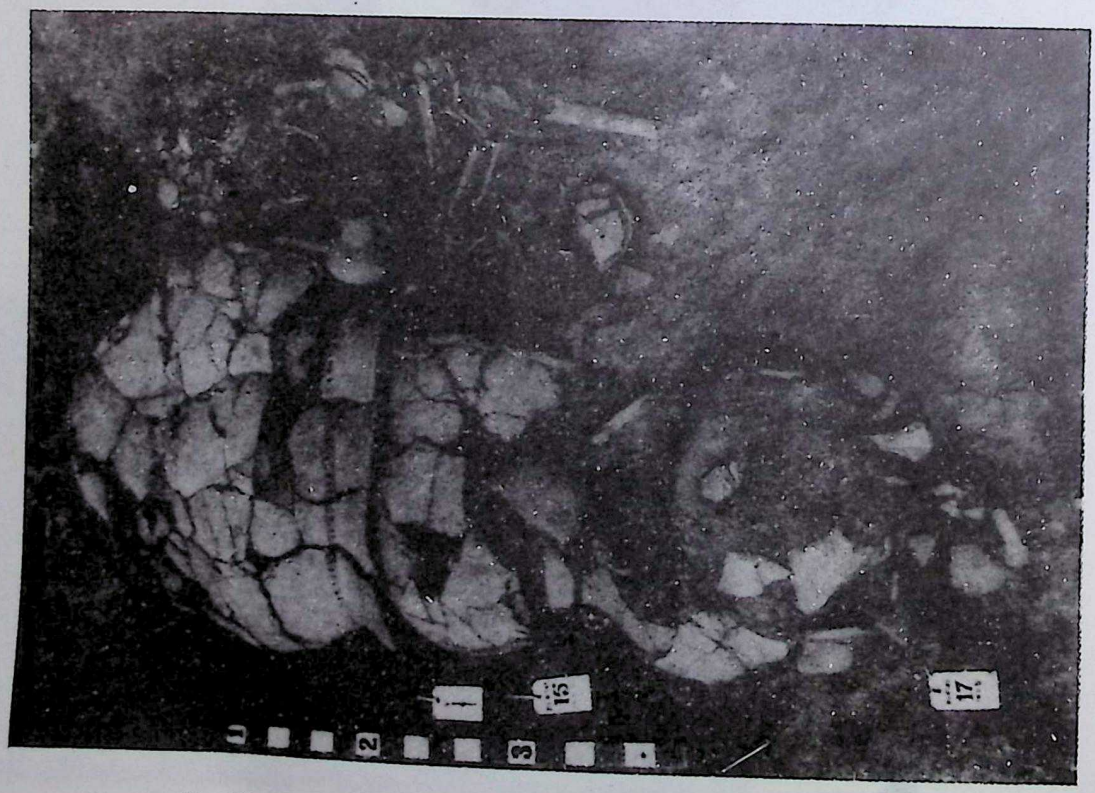

Fig. 23: An urn burial from Chandoli (courtesy Deccan College).

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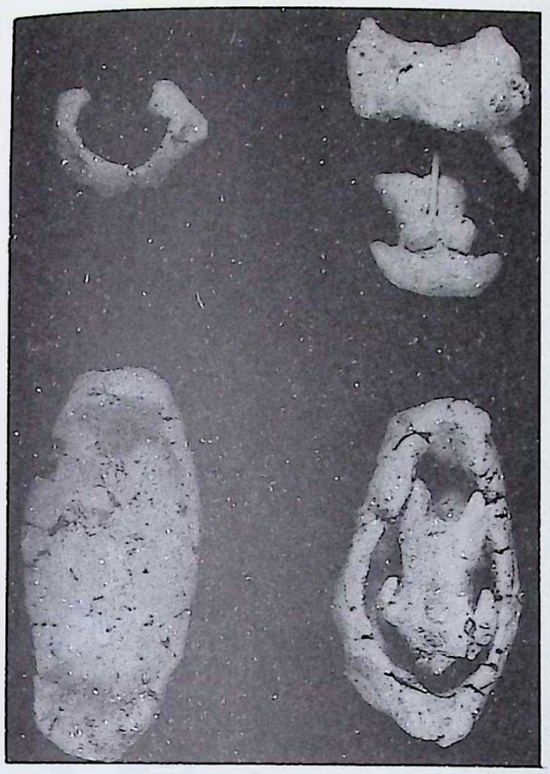

Fig. 24: Probably ritualistic terracotta figurines from Inamgaon (courtesy Deccan College).

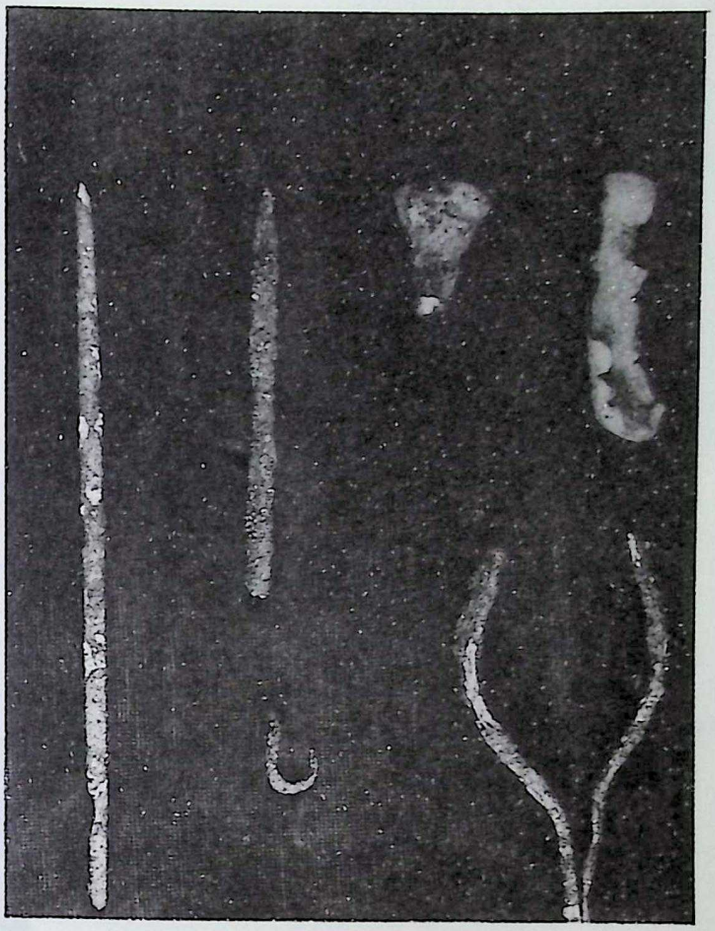

Fig. 25: Copper artifacts from Inamgaon (courtesy Deccan College).

Fig. 26: A copper fish-hook from Chandoli, Chalcolithic level (courtesy Deccan College).

Fig. 27: The Copper dagger from Chandoli with a split handle (courtesy Deccan College).

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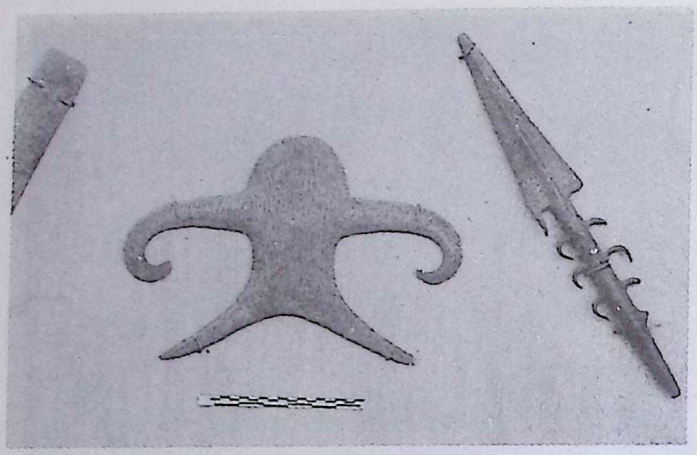

Fig. 28: The Copper Hoard Types: A copper flat celt, an anthropomorph, and a harpoon from Bisauli, Dist. Badayun, UP.

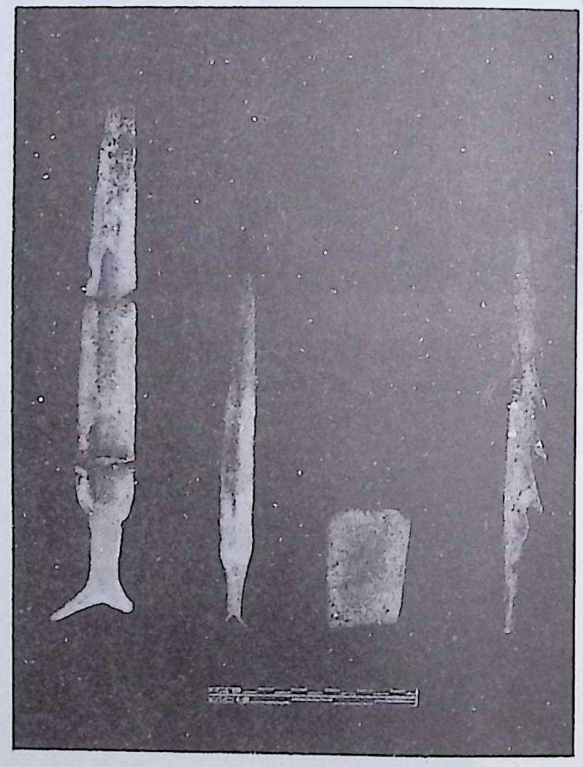

Fig. 29: Typical Copper Hoards types: antennae hilted swords and harpoon from Chandausi, UP.

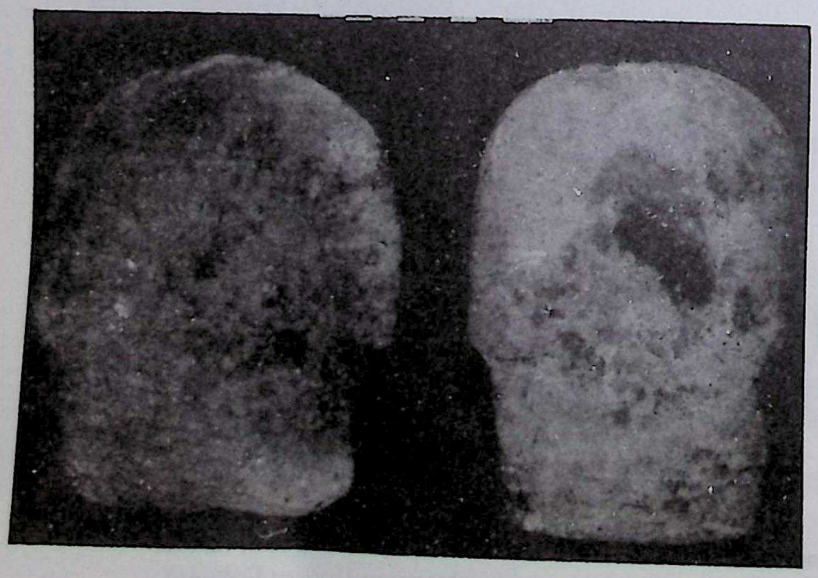

Fig. 30: Shouldered celts of copper from Itava, Dist. Varanasi, UP.

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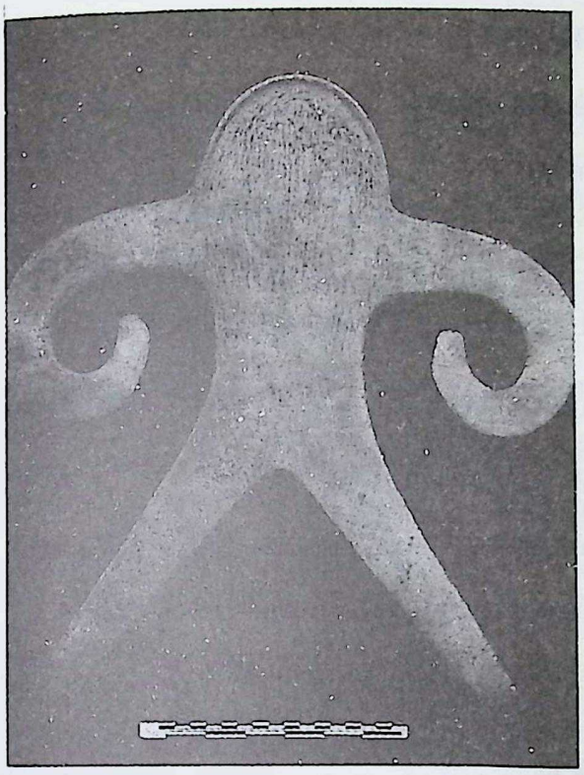

Fig. 31: A typical anthropomorph from Bisauli, Dist. Badayun, UP.

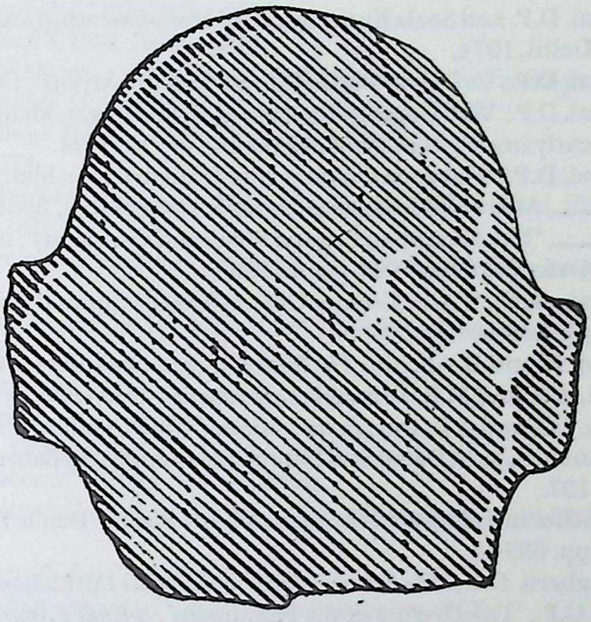

Fig. 32: This so-called anthropomorph from Lothal has a flat rectangular section, unlike the typical Copper Hoards where the head is considerably thickened.

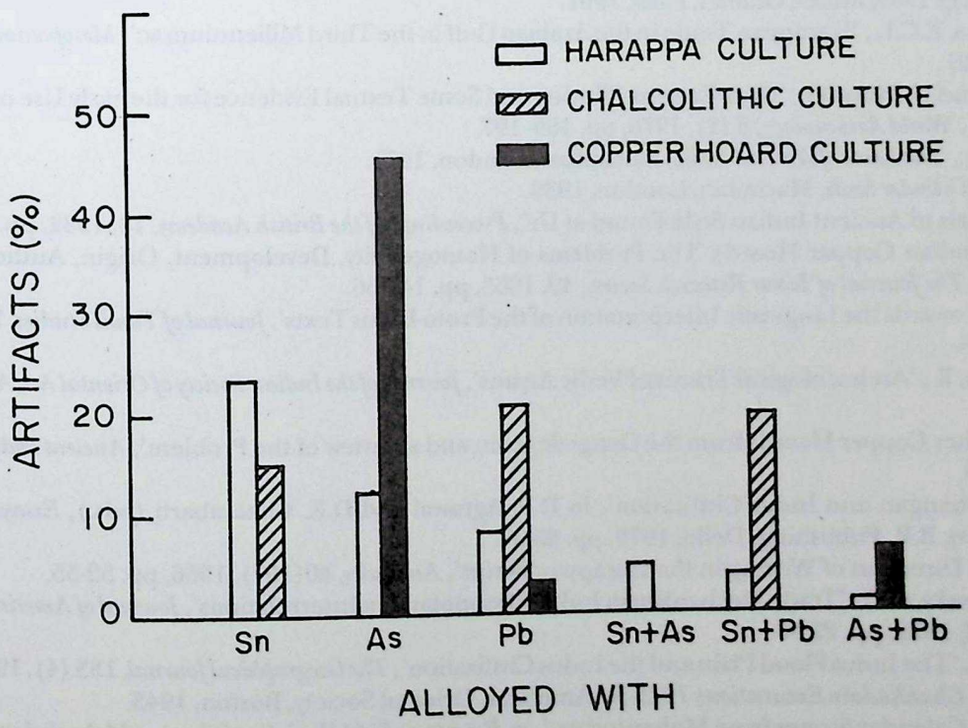

Fig. 33: Histogram showing the relative use of tin (Sn), arsenic (As) and lead (Pb) for alloying in the artifacts belonging to the Harappa, the Copper Hoards and the Chalcolithic cultures. It is worth noting that the Copper Hoards show an exclusive use of arsenic and the Chalcolithic artifacts of tin, whereas the Harappans mainly used tin, though they also used arsenic to some extent.

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CHAPTER XVI

Early Iron Technology and Its Socio-Economic Impact

Vibha Tripathi

The second urbanization of Indian History was a result of innovations and advancements taking place during the course of the first millennium BC. This was a period of immense activity in diverse fields. The closing centuries of the first millennium BC witnessed growth of the earliest cities and foundation of Magadha imperialism in the heart of the Gangetic plains. The precise causes of the overall cultural upsurgence are still unresolved and are subject to heated controversy. Indeed, the process of urbanization is a complex phenomenon. Though urbanism is not the subject of the present discussion, we propose to examine the socio-economic conditions wherein the earliest cities, as well as the imperial powers, established themselves.

A strong foundation was laid by building up an economic background over the centuries, on which the imperial powers rested. It needs to be examined, however, whether technology played any role in this upsurgence. Without raking up controversies concerning the second urbanization, it may be stated that economic prosperity is essential to social prosperity. Technology is an asset in this process. Amongst the most vital technological innovations in the crucially significant first millennium BC, was the advent of iron metallurgy. It is believed that 'the metallurgical tradition can offer insight into the nature of changes taking place across a cultural level.' (Young, 1967 pp. 11-34). As a utilitarian metal, iron is specially significant among the metallurgical traditions. "Iron as an innovation represented a new line of development, a recombination of previously existing knowledge which resulted in an entirely new technological configuration" (Wallace 1972, pp. 467-478). Iron, indeed was the sturdiest and most utilitarian and also amongst the most prolific and easily accessible metals available to man on the earth's crust. It represents a culmination of technological skill attained by man in his strides towards material prosperity. It was capable of changing the course of human history. To be able to arrive at any reasonable understanding of socio-economic changes as a result of the adoption of iron technology, we need to focus on that point of Indian history when iron was introduced followed by a close examination of how, when and under what circumstances iron exerted its impact on socio-economic life.

Iron was introduced in the Gangetic plains (incidentally also the cradle of Indian civilization during the second urbanization phase) in *circa* 1000 BC. The social adaptation to the new technologies was excruciatingly slow, perhaps in keeping with society's traditional temper. It was initially utilized primarily for weaponry, perhaps to acquire and exert supremacy over other tribal groups. Iron technology was harnessed for economic activity

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much later as would be shown below. It is this fact which has been ignored by Ghosh (1973), Lal (1984), Chakrabarti (1974), Gupta (1992) and several others while arguing that iron fails to bring about any changes in the socio-economic milieu.

As the material culture of the first phase of the introduction of iron hardly shows any signs of change, we need to address ourselves to questions like at which point of time was iron technology sufficiently consolidated to be in a position to exert an influence on productivity. When was iron typology diversified sufficiently to facilitate its widespread use? When do we discover change in cultural material and which are the specific areas of influence at different levels? How are these changes reflected in material remains? These issues may be resolved by first defining the stages of technological growth in India. This should be followed by a discussion on archaeological data, highlighting both the cultural material as well as the iron tool repertoire at diverse stages. In the next section a proper appraisal of the state of technological skill has to be made to indicate as to when it was in a position to exert noticeable influence on life in general. An attempt is being made below to take up these issues.

THE AGE OF IRON IN INDIA

Young (1967, p 11-13), defining the iron age in Iran, classified the age as Iron I, Iron II and Iron III on the basis of the degree of usage of iron at different cultural stages. Piggott (1980, pp. 421) briefly defines Iron I with a very scant presence of evidence of iron exclusively in graves in 1000 BC in Western Iran. In Iron II (1000-800 BC) iron appears for the first time in settlements along with graveyards. Iron III (800-550 BC) experiences a transition in culture with a fairly reasonable increase in the use of iron. Protohistoric India also underwent changes which match closely those in Western Iran. This has been discussed elsewhere (Tripathi, 1992-93).

Iron I (12/1100 BC-1000 BC)

Stray occurrences of iron have been reported from Noh (Pre-PGW phase), Jodhpur and Kausambi (Black-and-Red ware phase). Pandu Rajar Dhibi, Hatigra and Mangalkot in West Bengal have yielded iron from the Chalcolithic cultural phase. The occurrence of iron at Ahar has been highlighted by Sahi (1979) but this is still disputed and considered controversial by several archaeologists.

Iron II (10/900 BC-6/500 BC)

From the beginning of the first millennium BC, a regular use of iron starts in several areas in India. In the divergent contexts of the north-western parts of the sub-continent with cairn burials with Painted Grey Ware culture, with Black-and-Red Ware culture in the middle and lower Gangetic plains and with Megalithic Cultures in Deccan and Peninsular India, we come across uninterrupted use of iron. In Western Iran, iron at this stage '*leans heavily in the direction of weaponry in terms of sheer number* (Piggott, 1980, p. 430). Similar was the case in India.

Iron III (6/500BC-3/200 BC)

The grey pottery of the earlier stage was replaced by Northern Black Polished Ware, a highly sophisticated ceramic. The use of iron becomes comparatively more prolific with diversification in tool typology. Both the literary tradition and analytical work suggest that the technology of iron working undergoes an improvisation at this stage.

Further modification may be suggested in this classification when applying it in the Indian context. The first two categories, above i.e. Iron I and Iron II, may be grouped together and labelled as *Early Iron*, as it is extremely localized and confined to a few sites only. Actually,

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a regular and uninterrupted use of iron in India begins from the Iron II stage and Iron III may be termed the *Mid Iron Phase*, and the subsequent stage, i.e. the Sunga-Kusana and Gupta levels of Indian history may be termed the *Late Iron Phase*. With this we proceed to study these three stages of the Iron Age, primarily in Northern India.

I. SETTLEMENT PATTERN AND MATERIAL CULTURE IN THE IRON AGE

The Indo-Gangetic plains, right from the valleys of rivers Indus through Yamuna up to Ganga, transversing the entire expanse of North India, were inhabited by Iron Age societies almost from the very beginning of the first millennium BC. As a result of intense archaeological activity, a large number of sites have been plotted. The important excavated sites of the period are Noh, Jodhpur (Rajasthan); Ropar (Punjab); Atranjikhera, Alamgirpur, Ahichchatra, Jakhera, Hastinapur, Kausambi, Rajghat, Khaiadih (UP); Eran, Nagda (MP); Senuwar, Manjhi, Chirand, Vaisali, Sonpur, Taradih (Bihar). Though important evidences come from Bengal also, there are virtually no reports giving detailed information concerning their cultural material. A reasonable amount of information has been gathered about these cultures over the last few decades. Horizontal excavations, however are still rare in Indian archaeology. As a result, there are lacunae in a detailed understanding of the life of people at specific cultural horizons. Even working under these constraints, a reasonable reconstruction of material life may be attempted at the three stages defined above. To underline the changes at consecutive cultural phases which are not radical but transitional in nature, it is vital to give a comparative assessment of individual cultural contact vis-a-vis technological changes.

The Early Iron Age

The reconstruction on life—both settlement pattern and material remains is based on Painted Grey Ware culture in Rajasthan, Punjab, Haryana and Western U.P. and Black-and-Red Ware culture in Eastern U.P., Bihar, and Bengal.

The Settlement Pattern: As the time of introduction of iron, the nature of culture was predominantly Chalcolithic. The moderate sized habitations were confined only to one corner of the mound. Little is preserved by way of structural remains for this stage of culture except for mud-bricks or post-holes.

Haphazard or unplanned habitations of thatched roofs or mud-plastered reeds were the norm. At Kausambi and Hastinapur mud-brick walls have been met with during excavations.

Towards the end of this period restricted use of baked-bricks have been reported from sites like Rajghat and Atranjikhera, Protective bunds or moats have been noted at Atranjikhera and Kausambi and outside Gangetic Basin at Eran in Madhya Pradesh. But it is not a norm at this stage even though most of the settlement are on river banks.

Material Culture: At most of the sites, the earliest strata demonstrates an elementary food-gathering and food-producing economy. The earlier bone-stone tools and implements continue in sizable measure. The norm is an elementary food-gathering-food-producing economy. Iron tools, mostly hunting tools, were introduced in this setting. The number of these tools is extremely restricted.

Agriculture was being practiced as is testified by cereal remains of rice, wheat and barley. There is a near dearth of agricultural implements of iron that suggests a low priority to cultivation so far as the application of the new technology to it was concerned. Animal husbandry has a high priority, as is indicated by the large number of animal bones in excavations of PGW sites yielding—cow, buffalo, goat, sheep, pig and dog bones. Large numbers of riverine animals and fish are reported from Rajghat from Black-and-Red Ware.

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Animals were being used for meat and milk, both suggesting a heavy reliance on animal husbandry as is also clear from recurrent references to cattle in both early and later Vedic texts. Hunting has been a sport and, perhaps, also a necessity. The ritualistic significance of cattle and horses in Vedic texts are important pointers. Whether animals were being used as draft animals or for ploughing is not directly evident from archaeological remains. Both toy-carts and ploughed fields have been found at the Indus Cultural Levels and the Vedic texts refer to them (the Sira or Sita in the *Ṛgveda*). Towards the later phases, the ploughshare has been reported from Jakhera and also at Kapilavastu (Black-and-Red Ware phase). The river banks which were being colonized could be ploughed with a wooden ploughshare too, the soil being usually soft and silty there. The land away from the rivers was heavily covered by forests and was hardly utilized for cultivation at the earliest stage of occupation.

Any trade and commerce worth the name is hardly discernible. No coinage was known; small discs of cherts and jasper at Hastinapur have been identified as weights by Lal. It is not very clear though as what merchandise required such tiny weights (!), but barter, presumably must have been prevalent in such self-sufficient societies.

Terracotta figures are confined to a few animal figurines alone. Amongst the terracotta objects, discs were the most common commodity, coming in large number from various excavations. In view of Sinha (Paper presented at IAS Congress, Allahabad), they served some ritualistic purpose. Interestingly, they have been found both at BRW and PGW levels in almost identical shapes and sizes. Terracotta ghata-shaped beads are other common commodity covering this large expanse of space. Terracotta bangles and balls of varying sizes are also available. Stone was not very profusely used, perhaps due to its non-availability in the plains. On more easterly sites, rivers were a source of a variety of stones which have been used for fashioning beads as well as utilitarian objects (Senuwar, B.P. Singh, personal communication and observation of material). Bone, horn and ivory were also being used for a variety of objects, including a large number of bone points which were commonly being used.

Glass was introduced at this stage. Beads and bangles of glass have been found from several PGW sites.

Copper was then rather a scarce metal in India. At the earlier stage, hunting tools like arrowheads, fish-hooks, celts etc. were also manufactured from copper. Primarily, copper was being used for ornaments, toiletries and, though rarely, for utensils. Small objects like pins, rods, hooks, and wires were frequently being used. Details of iron objects are given in Table 1 of Chart No. 3.

Mid Iron Age

The Early Northern Black Polished Ware and late NBP phases are not always distinguished especially in earlier excavations. A description of the material remains in accordance with this division is difficult to procure. The period from 700 BC to 200/100 BC is therefore being discussed under the Mid-Iron Phase. It covers the entire NBP cultural horizon which appears in continuation with the previous culture without any break at most of the sites.

The Settlement Pattern: The settlement pattern shows an improvement in view of the expansion of the area being occupied (see graph). If an area of 15,000 sq. m was occupied at PGW-BRW level (both the ceramics usually coexist at most of the sites), at the NBP phase the area expands to 22,000 sq. m at Early-Iron Level; covering an area of 5,000 sq. m at Jajmau (Makkhan Lal). In addition to size, the inhabitants also ventured away from the river banks to tanks or lakes, a feature never noticed at the earlier period.

A growth in population must be the main reason behind the expansion of size of sites. Building activity was intensified with bigger houses using both mud-bricks and baked-bricks, the latter being selectively used at the initial stages. With time, the size of houses grew. At

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Hastinapur a long wall has been traced, the other end of the wall could not be found Lal (1954-55). Kausambi yielded a double-storied, 28' x 15' house having sixteen steps (Sharma, 1960). Even at the early NBP level, lined drains or barns or wells with wedge-shaped bricks (baked) have been excavated at Atranjikhera, Roads with rammed potsherds, gravel and mud clods have been noted (Rajghat NBP level and Jakhera, at an earlier level and at the latter site).

Fortification became a common feature. At sites like Atranjikhera and Kausambi, the earlier fortifications were reinforced and at other places new fortifications were raised during the NBP period. Towards the final stages of this phase there was a spurt in building activity. Baked-bricks became a common feature. The new element in structural activity was the use of ring-wells of several types. If literary sources are any guide, the Mauryan capital at Pataliputra had impressive buildings. With imperial power coming into the picture, organizational capacity grew immensely. It is reflected most in building activity and architectural remains like Asokan pillars and other art forms.

Material Culture: The material culture shows an upward trend in general. Agricultural activity shows a marked increase with the presence of double-crop system. In addition to the earlier wheat-barley-rice crop, Kodon millet, black gram, green gram peas, khesari, sesame etc. were being grown in the Mid-Gangetic plains (Narhan). For the first time agricultural implements like sickle, axe, ploughshare, spades, hoe etc. of iron come to be used. The large-sized storage jars, granaries etc. suggest good agricultural yield.

Trade, even though on a small scale, shows an inter-regional relationship even in archaeological finds like beads, terracottas and raw materials like metal and minerals. The Buddhist texts of fifth-fourth century BC hint at the presence of a trading community. With the rise of Buddhism, travelling from region to region was common, so was the movement of organized trade. The presence of identical beads at Taxila and Sravasti speaks of trade between the two regions (Sinha, 1967). Occurrence on a large-scale of finished and unfinished beads in certain areas at Rajghat suggests that it was a big centre of bead-making; so were Ujjain and Vidisha. Raw material for crystal and topaz beads must have been brought in from long distances. The popularity of beads increased with time. At Atranjikhera there were only 12 beads at Stage I, the number rose to 43 in next phase, i.e. NBP period.

Northern Black Polished pottery itself was a prized commodity. Nearly twenty beautiful pieces at Taxila are clear proof of its being selected pieces reaching there through trade. The riveted sherds at Ropar again hint at its being a precious commodity. Figurines of terracotta show a marked improvement from the previous stage. The hand-modelled crude animal figurines of the Early Iron Age are transformed into Srasvati excavations' beautifully modelled and decorated animal figurines as well as an introduction of human figurines. Both hand-modelled and moulded figurines were being fashioned in large scale during this stage. Number of luxury goods increases. Beautiful ivory objects were carved and designed. Glass objects appear in comparatively larger numbers and variety.

Coinage appears for the first time at this cultural period. Punch-marked and cast coins both appear. The presence of coinage must have been an asset to trade and that should be the cause of the emergence of a system of coinage. Copper coins were most common, though silver was also used.

Copper was used for hunting tools like arrowheads (Hastinapur) though in small number. Other objects of copper found in excavations are hooks, chisel, borer, antimony rods, toiletries, nails, pairers, ornaments, pins, pendants, bangles, rings etc. The number of copper objects remains rather restricted. Iron objects rise both in number as well as types (see table). Interestingly, as pointed out above, agricultural implements appear for the first time and so do tools of masonry and carpentry which must have fulfilled the growing social need for these tools and implements.

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Late Iron Age

The Sunga-Kusana and, still later, the Gupta period was the culmination of Indian culture in every sphere of life. This hardly needs elaborations. The data is, however, being briefly presented here.

The Settlement Pattern: The settlement pattern is indicative of regular fortified cities. Indo-Gangetic plain sites like Ujjain, Vidisha, Eran, Nagda, Kausambi, Rajghat, Hastinapur, Atranjikhera, Taxila, Srasvati etc. acquired city status. Though no systematic work has been undertaken to study the city-village ratio, it is established that each big centre had its satellite settlements to support the economy. Large rivers still supported life and sustained trade and transport.

Material Culture: Art and architecture attained new heights during the Sunga-Kusana period. The art at Sanchi and Bharhut follows the woodcarving which must have existed earlier. The art at Mathura and Taxila are aesthetic masterpieces. They are witness to the skill of the sculptor's art which must have required excellent implements for carving and hewing stones which could be attained only with sharp-edged sturdy iron tools.

Pyrotechnologies like ceramic terracotta, glass and metallurgy, all had innovative trends. Without going into details it may be stated that the urbanization of the Gangetic valley came about full swing at this stage, which saw the Golden period of Indian history.

II. TECHNOLOGY—BEGINNING OF IRON

A techno-typological evolution of iron technology is essential for a proper understanding of this period. An attempt to discuss the growth of technology has been made elsewhere (Tripathi, 1993 pp. 47-58). A brief survey of iron technology at the three stages defined above is being attempted here. This may also explain as to why technology could exert its impact only at certain period and not earlier, as might be expected. Mere introduction of iron, it may be seen, was not sufficient condition to cause its widespread adoption.

Early Iron Age

Iron technology appears regularly in India from the beginning of the first millennium BC, give or take a couple of centuries at different cultures at different geographical locales. It is seen with Chalcolithic Black and Red Ware in the Middle and Lower Gangetic Plains, with Painted Grey Ware in the Upper Gangetic Plains, and with Megalithic cultures in Vidarbha and Peninsular India.

The number of objects at this stage are very limited, so is the type of tools (see distribution table). Generally, we come across arrowheads, points, knife-blades, rarely axes and tongs, in addition to pins, nails, rods, clamps etc. A pair of tongs coming from Atranjikhera, from a smithy, is an interesting find from the PGW middle phase. Another interesting feature (revealed from Atranjikhera, Gaur, 1983) is that the lower phase of PGW culture has only seven iron objects and does not have even spearheads and arrowheads in mid phase. However, the number rises to 46 and 81 objects in upper phase of PGW culture.

Wrought-iron technology was the rule at this stage. The analytical data shows that the technique was in an evolutionary stage. Iron was extracted at low temperatures, ranging from 1100° C to 1300° C in the form of spongy bloom. Repeated heating and hammering in a forge at about 800-900° C provided some compactness to iron. Carbon in form of charcoal provided some strength too. There is slag inclusion in the matrix of ferrite (as revealed in the sample of Tadkanhalli, a megalithic culture site). A comparable piece of evidence is forthcoming from Hathikera in Bengal, an otherwise Chalcolithic culture (Ghosh and Chattopadhyay, 1989) and Pandu Rajan Dhibi (De and Chattopadhyay P.K., 1988).

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Iron thus produced had a little advantage over good-quality bronze with about 11 percent tin which will have a brinnel hardness of 60,000 per sq. inch which becomes 120,000 psi after cold working. Wrought iron has a brittle strength of only 40,000 psi.

A continued hammering or heating of such an iron will bring the strength of iron to 100,000 psi. In India, however bronze was hardly being used at Early Iron Age sites. We come across mostly unalloyed copper objects, that too in a very restricted number. At Khairadih we have come across a miniature arrowhead which is a replica of a stone specimen. It could be a ceremonial object. Such a situation throws out hints concerning the limited utilitarian value of metals at this stage.

A few examples of iron objects do hint at experimentations in iron working. The analysed sample from Hatigra (Ghosh et al., 1987) had a widmanstatten structure due to prolonged exposure at high temperature (1200 C) followed by slow cooling. It is a low-carbon hypoeutectoid steel. The concentration of carbon at edges, i.e., carburization, may be suggested.

Middle Iron Age

The Northern Black Polished Ware culture takes over the major part of North India by 700/600 BC. At certain sites it was contemporaneous with late-phase of Painted Grey Ware culture on the one hand and the Megalithic cultures on the other. This was a period of consolidation of iron technology with traces of steeling and case-hardening or carburization. There is a relative increase in the number and types of iron objects. There is thus, a qualitative and quantitative improvement in iron objects. We come across more sophisticated weapons like javelins, lances, daggers, blades, and elephant goads, along with the earlier types, which become more prolific. Agricultural implements which were rarely reported from a few sites only (sickle and ploughshare from Jakhera; axe from Atranjikhera) came in vogue now.

Though solid state reduction of iron remains the basic technique of iron smelting, there was improvization in technology; steeling was being applied more frequently. Whether carbon was accidental in the body or iron is uncertain as two samples pertaining to the same period from Prakash show distinct conditions (Thapar, 1965). While sample No. 29 indicates a low metalloid content, indicating solid state reduction, sample No. 30 shows presence of equiaxed ferrite grains with a small amount of pearlite at the grain boundaries and presence of streaks of iron oxide and slag. The chemical composition shows steeling.

In a broader framework, the results have been corroborated by samples from Rajghat. A total of six samples belonging to the BC 600-400 level were analyzed. All of them are wrought iron having slag inclusion. Evidence of carburization has been attested to (Bharadvaj, 1973). Sample No. 6 has 1.4 percent carbon. It is difficult to ascertain whether carburization was deliberate as only one sample shows signs of it. It is worth mentioning here that the humid climate of this region is damaging to iron. A thick layer of corroded iron comes off the finds and invariably only the core remains after cleaning. It is difficult to detect any traces of carburization from the deep core of corroded objects. A 300 BC sickle from Pandu Rajar (Chattopadhyaya, 1988) had iron with a ferrite-pearlite matrix reveals evidence of quenching and tempering—a highly evolved technique of iron manufacturing. Pali texts of the fifth-fourth century BC have also hinted at quenching.

Late Iron Age

Iron technology attained new heights during the Sunga-Kusana and Gupta periods. It culminates with the production of objects like the Iron Pillar at Mehrauli, Delhi. Taxila has yielded armour-grade weapons; Sisupalgarh, a caltrop. Maximum variety and a large number of objects are reported from this period. With availability of samples, objects from this phase have been analysed. Hari Narain at NRLC, Lucknow, analysed five objects from Sringverpur

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(Hari Narain et al., in press). Different techniques were found to be applied on separate categories of objects, e.g. a spoon had a lower hardness than that of an axe. The carbon content varied from 0.1 percent to 0.6 percent. There was rapid cooling and widmanstatten structure with the ferrite and pearlite cutting edges. The cutting edges were found to be carburized further, giving them greater hardness. This high carbon zone had low slag inclusion too, confining itself to deeper areas. Most of Sringverpur objects belong to a category of mild steel with cementite. Lamination technique was prevalent, especially for knife-blades (Hari Narain, op. cit.).

Khairadih, a site in Ballia district on river Ghagra has yielded a rich repertoire of iron objects, especially at Sunga-Kusana level. Some of the objects were analysed at BHU. Most of them indicate pure wrought-iron with some slag inclusion. A spearhead, however, shows pearlite and ferrite phase though slag inclusion is detectable. The micro-structure also suggests quenching and tempering, both rare features. The other samples have a banded structure of ferrite and pearlite with elongated slag inclusions. Bhanu Prakash (personal communication) feels that the micro-structure carbon content in iron is due to forge-welding of a number of sheets for thick iron objects. The high level of iron technology at Khairadih is detectable in the manufacture of an axe with shaft hole. The radiography shows lamination. No crevices or voids are seen in welding. The hole is punched by piercing a hot steel punch or bending the sheet and then forge welding them so efficiently that joints or seams are not detected even in the radiograph. The evidence of Taxila is unique of its kind, both in typological representation and technical skill. Hadfield had admired the skill of the smiths (Hadfield, 1975, new ed., Taxila), writing, 'evidently the Indians in this locality and at this period quite deliberately made high carbon steel'. Some of the artifacts contained 1.3 to 1.23 percent carbon, falling in the category of high-carbon steel.

DISCUSSION

This survey of technological data speaks of a gradual evolution in iron technology from simple wrought iron technology to steeling.

Despite very limited study by way of analytical work, carburization, tempering and quenching have been detected. This is against the odds of heavy corrosion, especially in the Middle and Lower Gangetic valley which grew to be a centre of cultural activity after the first half of the first millennium BC.

Indeed, no technology develops for its own sake. There has to be a balance between demand and supply. Technological development is in response to social demands. The availability of effective artifacts accelerates productivity. This is a kind of a symbiotic relationship, one activity supporting and promoting the other. 'The use of iron', comments Chakraborty (1992, pp. 57), 'obviously increased in the Mauryan and Saka-Parthian-Kusana phases but this need not suggest anything more than an increased complexity of the economic and social effect in these periods.' This emphasis of Chakraborty on a total subordination of technology to economic productivity is not understandable. It is not to be suggested that any single factor could revolutionize the socio-economic structure of a period but a contributory role of technology in bringing about a transition in economic productivity is imperative. Its significance cannot be marginalized. Indeed, the social structure had to be ready to exploit its resources but the basic infrastructure had to be available and handy; 'to improve the chances for an innovation to be accepted, its adoption must be perceived as advantageous to society; facilitating this is a degree of knowledge about how to properly use the new idea' (Rogers and Shoemaker (1971, p.19). In the present context, the iron technology was present for centuries but the smithy was underdeveloped for a long time. With time, the technology

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developed and so did demand for it in society. If we juxtapose the evidence of material culture with the technological data given above, a pattern of growth becomes evident. Technological development synchronizes with cultural growth: in diverse fields of structural activity, agricultural produce, art and craft, masonry and carpentry, with increasing application of iron technology in these crucial areas. It may be apt to briefly reflect on the subject here.

At the earliest strata of colonization of the Doab, the settlements were flimsy, even at the early PGW sites (which were comparatively more prosperous), the habitation was confined to the small area of the mounds. Graph 1 shows the relative area under occupation at four cultural levels, viz. BRW, PGW, NBPW and Post-NBPW in Kanpur District (Lal, 1984, pp. 154-7). From BRW/PGW, the NBP settlement grows one and half times to double the original size. The process continues in the subsequent period. Larger population and better-planned settlements gradually covered the plains of Northern India in course of time.

The inhabitants even ventured into more interior regions, away from river courses. Even at PGW level, the site of Dhansari in Aligarh District is 5 m away from Nim, a tributary of the Kalinadi (Sahi, 1987, p. 32). This feature becomes more common during the NBP period (discussed above). With availability of better tools and artifacts for tilling and for digging wells and canals (evidence well corroborated from excavations of NBP sites), it was possible to settle away from the flood-infested river banks. Such settlements could also be serving specific purposes, being close to mineral resources (the subject discussed in detail elsewhere, Tripathi and Tripathi, 1992-93; in press).

In addition, the town-village ratio gradually established itself. Mughal's study of the settlement system in Bahawalpur State and of Kanpur district by Makkhan Lal, Haryana region by Brahmdutt have given data on relative positions of village—small town—big town. In Bahawalpur (Pakistan), 14 PGW sites have been plotted. Seven of them are within 1.1 and 2 ha; three of them within 3 and 4 ha; while one site is at 13.7 ha.

The adoption of iron technology revolutionized art and architecture by the third century BC. Though stone sculpture comes into picture with the prevalence of Buddhism, it could do so only with the availability of sharper and sturdier cutting tools and implements of the craft. An important evidence of this comes from Taxila where a sharp chisel got embedded and was left *in situ* in the main body of a pillar (Hadfield in Marshall, 1975 reprint). The Ashokan pillars and subsequent stupa art became possible only thanks to efficient iron implements. (Of course the imperial powers could command and organize the artisans, but the technology had to be handy.)

Agriculture, as shown above, also benefited from iron tools. No effect of iron technology was seen at early stages of its occurrence because of lack of application. Rice which was being cultivated grew in heaps (Chowdhury, 1977). The evidence is well corroborated from Sonpur I B where 5 kg of charred rice grains were procured. Wheat was being grown in the upper Gangetic Valley by PGW folks was used for the first time. It required frequent ploughing and tilling of land and digging of canals for irrigation. It could be achieved more effectively with iron tools which come into existence with the NBP level on a regular basis.

These factors suggest an interrelationship between technological innovations and economic growth. The adaptation of new technology was very slow, which explains why the effects of iron technology were not visible at early levels. In the view of Trigger (1967), the interaction between environment and technology as reflected in the adaptation of a society and its technology to its environment is extremely significant. Most of the iron age sites are located in the Gangetic plains while the ore deposits are located in hilly and forested terrain. It must have been an arduous process to (*a*) locate the ore deposits, (*b*) to understand the intricacies of ore types in each area, and (*c*) finally to evolve the appropriate technique to work the type of ore available in a given area. There are other problems of relative importance, viz., transportation of ores to site or alternatively to develop a basic infrastructure to smelt the ore

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at the spot at which it occurs and bring only the ingots to town to be worked into finished products at leisure, when required. Evidence of the latter has been forthcoming from several areas in southern Uttar Pradesh, details of which are still being worked out by us. Incidentally, this area is also rich in ethnological data on metal-working, but it is not opportune to go into details here. However, these processes must have taken centuries to resolve and sort out and this may be important factors leading to delay in adoption of technology. The evidence of South Indian megaliths is also relevant in the present context. 'Knowledge of technology alone does not lead to the expansion of advanced production' argues Gurukkal, discussing the issue of economic and social structure (1987, p. 54). The megaliths are rich in iron artifacts but due to (*a*) the inhospitable hilly terrain in which they are located, and (*b*) a life-pattern emphasising wars, marauding and plundering, the culture never attained a prosperous status. In this situation, ecology as well as economic bias, perhaps due to ecological constraints, are the chief deterrent factors.

We may conclude on the basis of the aforesaid that though there is an interrelationship between technological advancement and economic prosperity, other factors also play a vital role. A sizable ecological and politico-cultural background is also necessary. That the advent of iron has been associated with the second urbanization in India is an issue which is still being debated. The very basis of this controversy is mistaken. Urbanism is the culmination of several factors and is a complex phenomenon. There may not be a simple solution to this very complex issue, especially in the complicated Indian context. Here, we are not concerned so much with resolving the issue of urbanism. So far as the impact of technology on the socio-economic state of a culture is concerned, it is clear that there is a strong relationship between the two. It has to be borne in mind, though that the social structure provides the foundation for growth. Innovations have to be adopted, accepted and organized to bring about changes. Well-executed technology management in a planned society brings about social changes. The gradual adoption of iron technology is a universal phenomenon. In the Near East the earliest iron artifacts appear around 3000 BC. However, its regular use for utilitarian purposes begins only around 1200 BC. Both technology as well as social structure had to arrive at a compatible level to adapt to each other. Discussing a similar situation in the Near East, Piggott (1982, p.25) states. 'To conclude then, knowledge of iron and ability to produce it intentionally preceded its widespread adoption by centuries in Near East. Given the current state of our understanding of technological phenomenon of iron metallurgy, it appears that socio-cultural processes exercised a somewhat greater influence in the ultimate acceptance of iron as an innovation than any immediate recognition of the metal's potential or realized technological superiority.'

Tool Type	*Name of Tools*	*E*	*M*	*L*
Hunting Tools	Spearheads	*	*	*
	Arrow heads	*	*	*
	Points	*	**	**
	Socketed tangs	*	**	**
	Blades	*	*	**
	Spear lances	**	*	**
	Daggers	**	*	*
	Swords	**	*	*
	Elephant goads	—	*	*
	Lance-set tangs	—	—	*
	Armours	—	—	*

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Tool Type	*Name of Tools*	*E*	*M*	*L*
	Helmets	—	—	*
	Horse bits	—	—	*
	Caltrops	—	—	*
Agriculture Tools	Axer	*	*	*
	Sickles	*	*	*
	Spades	—	*	**
	Ploughshares	—	*	**
	Hoes	—	*	*
	Chisels	—	*	*
	Picks	—	**	*
House Hold Objects	Knives	*	*	*
	Tongs	*	**	**
	Discs	—	*	**
	Rings	—	*	**
	Spoons	—	*	*
	Sieves	—	—	*
	Couldrons	—	—	*
	Bowls	—	—	*
	Dishes	—	—	*
Building Material	Rods	*	**	**
	Pins	*	**	**
	Nails	*	*	*
	Clamps	*	*	*
	Pipes	—	*	**
	Sockets	—	*	**
	Plumb bobs	—	*	**
	Chains	—	*	*
	Door hooks	—	*	**
	Door handles	—	—	*
	Hinges	—	—	*
	Spikes	—	—	*
	Tweezers	—	—	*
	Anvils	—	—	*
	Hammers	—	—	*
	Scissors	—	—	*
	Saws	—	—	*

Table 1: Distribution of tool typology.

Legend:

* = Definite existence
** = Confirmed data not available
— = Non-Existence

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IRON OBJECTS FROM ATRANJIKHERA
(PGW 1000 – 500 B.C.)

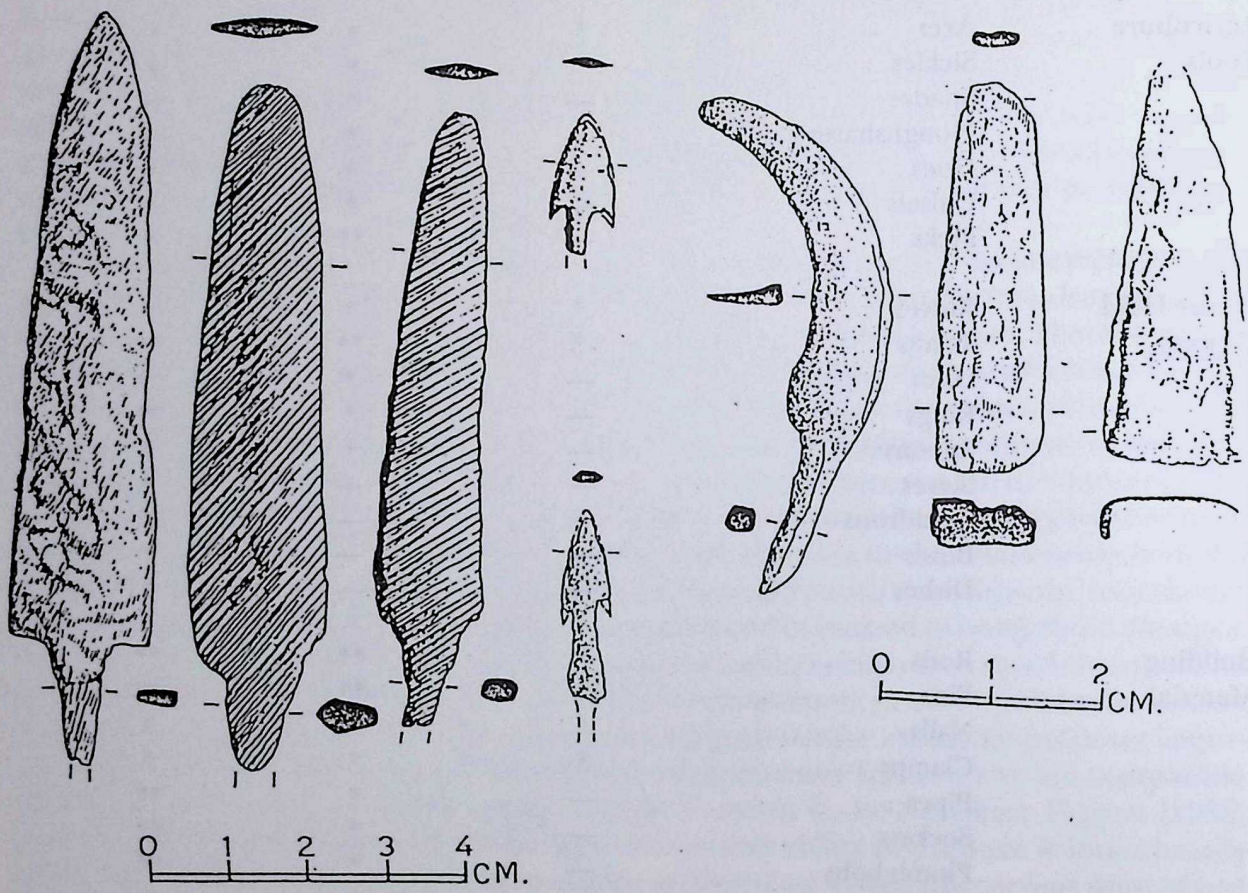

Fig. 1: Iron Objects from Atranjikhera (PGW 1000 – 500 BC)

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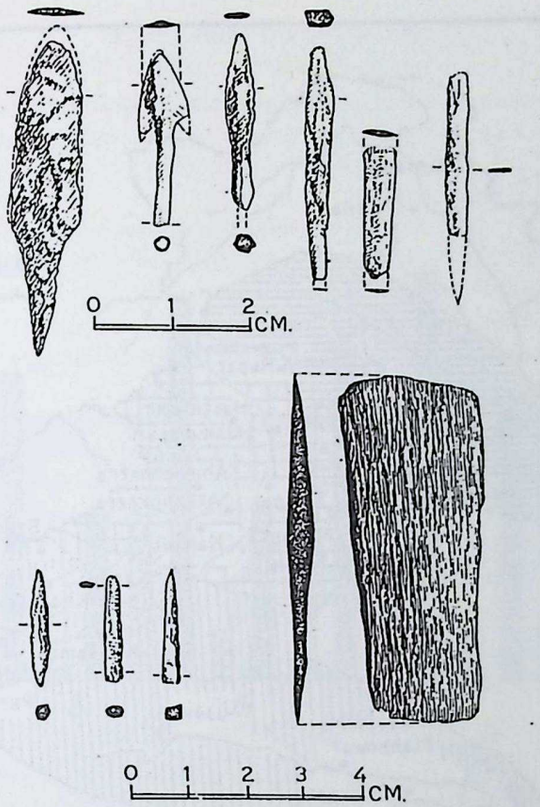

Fig. 2: Iron Objects from Atranjikhera (NBPW 500 – 100 BC)

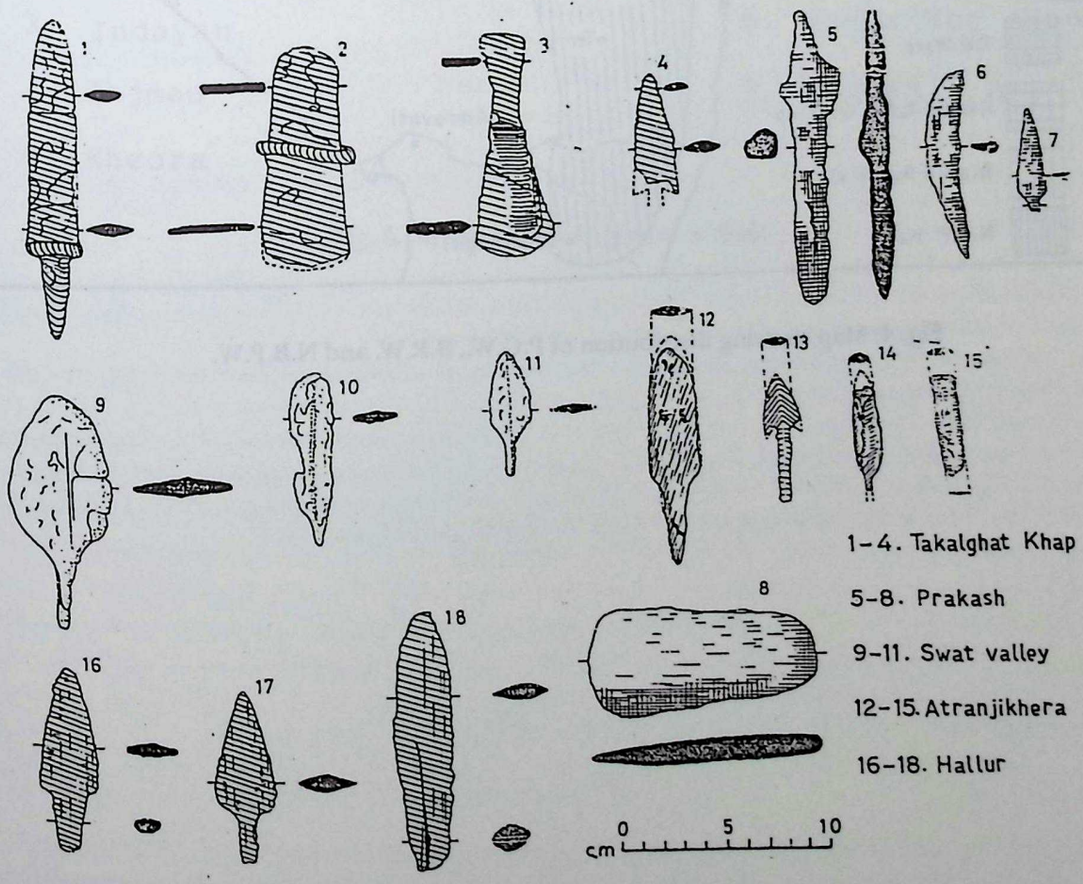

Fig. 3: Iron Objects from the Earliest Levels (1100/1000 BC – 800 BC)

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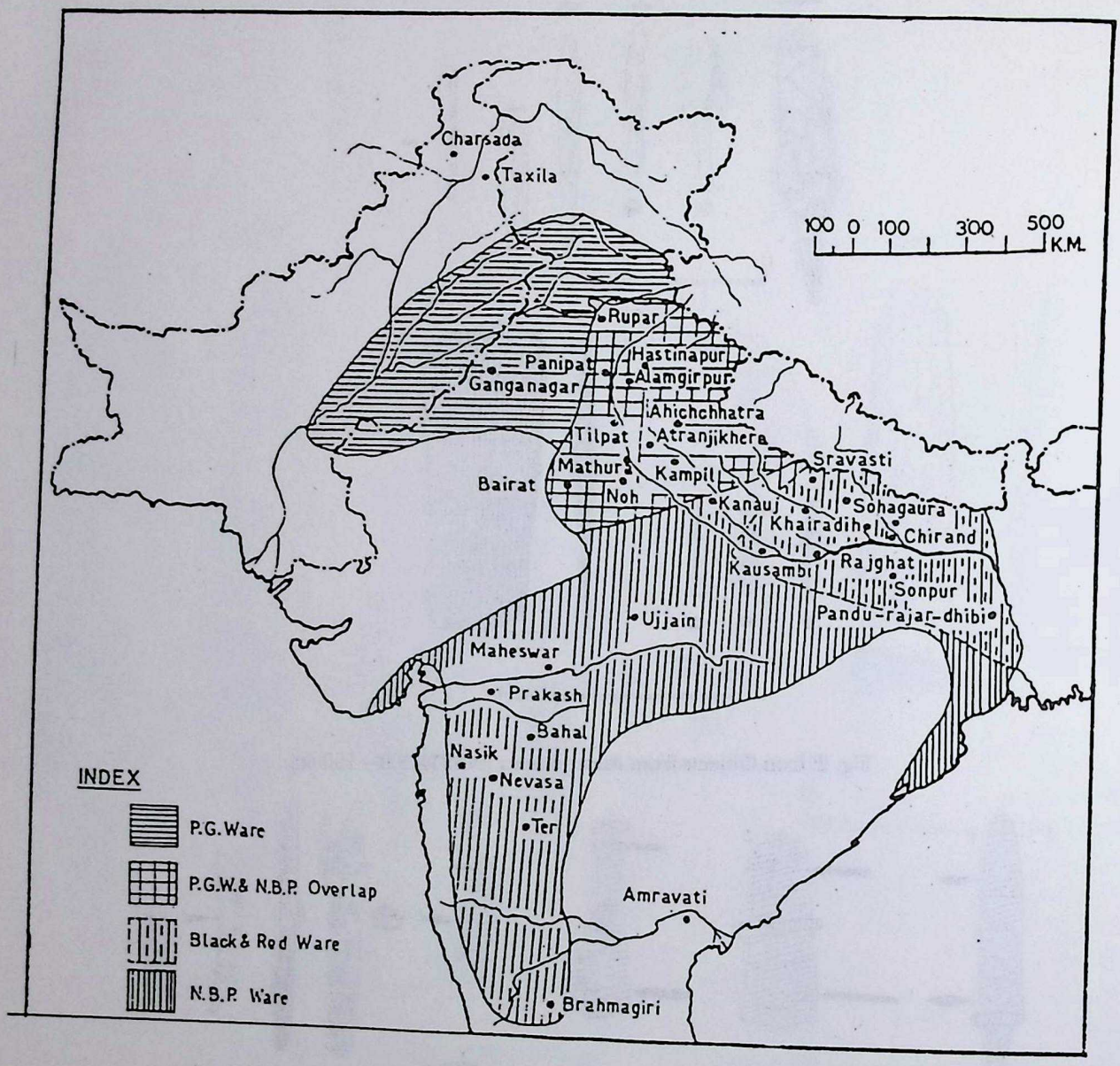

Fig. 4: Map showing distribution of P.G.W., B.R.W. and N.B.P.W.

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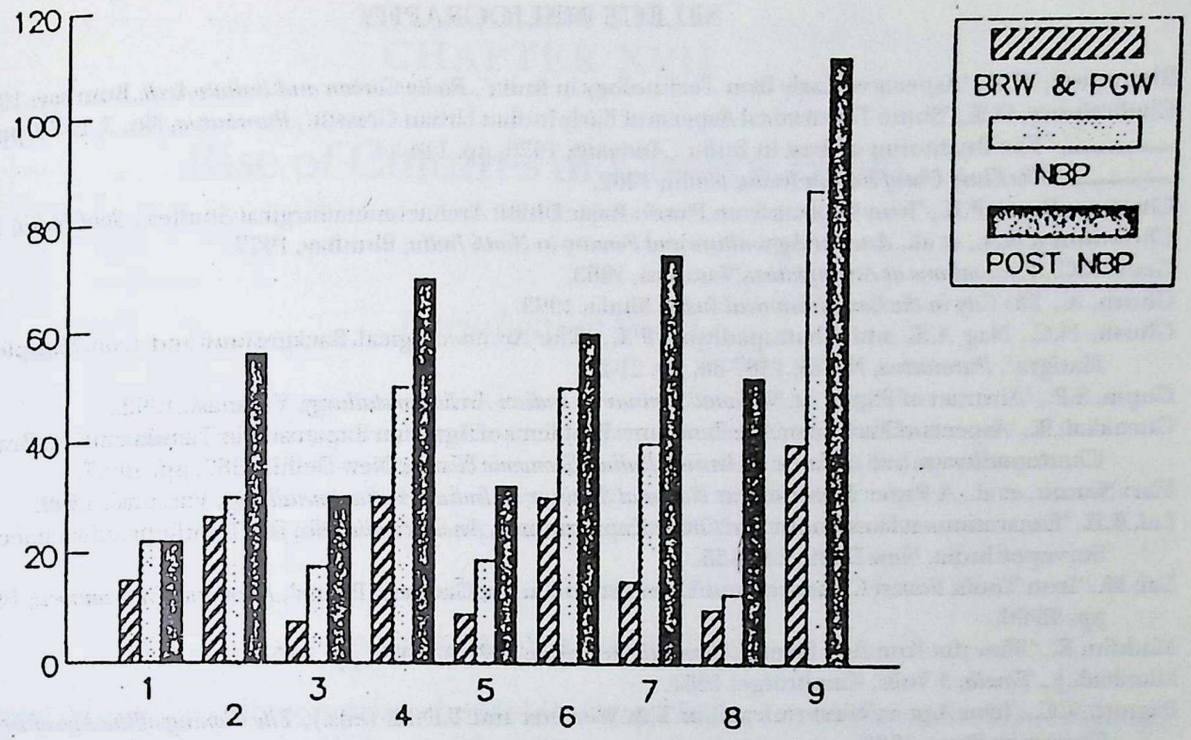

1. Bijapur
2. Galatha
3. Indayan
4. Jajmau
5. Kheora
6. Musanagar
7. Nawabganj
8. Nonha Nar (Kanpur)
9. Radhan A

Fig. 5: Size of settlement (sq.m × 1000)

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CHAPTER XVII

Rise of Cultures in Eastern India

Purushottam Singh

GEOGRAPHICAL BACKGROUND

Eastern India broadly comprises the Middle Ganga Plain, the whole of the Lower Ganga Plain, the Brahmaputra Valley and the hilly tracts of sub-Himalayan regions. The Middle Ganga Plain comprises major parts of eastern Uttar Pradesh (east of the Faizabad-Allahabad line) and the Bihar plains. This region, covering an area of about 1.44 lakh square km, is a homogeneous, featureless plain with local prominences like levees, bluffs, sandy features, ox-bow lakes, tals, chaurs and remnants of river channels. Based on the river system, it has the following physiographic sub-divisions:

1. The Ganga-Ghaghara Doab
2. The Ghaghara-Gandak Interfluve (Saryupar Plain)
3. The Gandak-Kosi Interfluve (Mithila Plain)
4. The Kosi Plain
5. The Karmnasa-Son Interfluve
6. The lower Son Valley
7. The Magadh-Anga Plain

The Ganga is the master stream and the recipient of all water lines in the region. Floods are a recurring feature to the north of the Ganga and almost all the rivers have shifted their course frequently, covering wide areas throughout historic times. The Ganga has shifted over 35 km while the Kosi has shifted its course over 120 km in recent times. With moderate rainfall and fertile soil, it is one of the most densely populated regions in the world.

The Lower Ganga Plain includes the Kishanganj and the Purnea districts of Bihar and the whole of West Bengal, excluding the mountainous parts of Darjeeling district in the north. The region covers an area of about 81 thousand sq km of which the real delta constitutes two thirds. At the micro level this plain has been divided into three sub-divisions:

1. The Northern Plain (Murshidabad and Nadia districts and the mature delta)
2. The active delta of Sundarbans
3. The western margin of the delta called the *Rarh* Plain

The main drainage system comprises the tributaries and the distributaries of the Ganga and the Brahmaputra. The Tista, descending from the Himalayas, was a tributary of the Ganga prior to the disastrous flood of 1787 when it drifted eastwards to join the Brahmaputra. The

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region experiences generally a hot and humid monsoonal climate. Tropical forests are the most important feature of this plain.

The Assam valley or the Brahmaputra valley is surrounded on all sides by mountains, except on the west. This valley covers an area of about 56,274 sq km with an east-west stretch of about 720 km and an average width of 80 km. This valley is characterized by a steep slope in the northern margin but the southern margin has a gradual fall from the northern hill ranges. An important geomorphological feature of the valley is the presence of a good number of isolated hillocks on both banks of the river. On the northern bank innumerable tributaries running down from the Himalayas debauch abruptly to the main valley. The Brahmaputra itself rises in the Kailash range in Tibet where it is called Tsangpo. After entering the Siang division of Arunachal Pradesh, it is called Dihang and from Sadiya onwards it flows as the Brahmaputra. A noteworthy feature of this river is that it is highly braided due to its low gradient. This has resulted in the formation of innumerable riverine islands, the largest being Majuli (929 sq km). In the monsoon season the river resembles a slow moving lake, at places being as wide as 8 km from bank to bank. It has more than 35 tributaries. Floods are an annual menace to agriculture and settlements in the valley.

The lofty ranges in the north protect the valley from the cold airmass of Tibet and cause heavy relief rain by obstructing the southwest monsoon winds. The vegetation of the region is predominantly characterized by mixed semi-evergreen, evergreen and deciduous types, owing mainly to the heavy monsoonal rainfall, effective temperature and thick, fertile soil cover. The soils in the valley are alluvial in character and are most suitable for the cultivation of rice, tea, jute, pulses and mustard.

NEOLITHIC BACKDROP

The Neolithic cultures of India have been divided into several provinces by various scholars, (Krishnaswami, 1962), (Thapar, 1965, 1974, 1978, 1985), (Sundara, 1985), (Sharma, 1981), (Varma, 1988) and (Sant, 1991) and no two scholars agree on one classification. However, taking into account every viewpoint, the following classification can be proposed:

1. Northern region, covering the Kashmir valley.
2. Vindhyan region, covering the Belan valley and the Vindhyan plateau in districts Allahabad, Mirzapur, Rewa and Sidhi.
3. Mid-eastern region, covering the northern Bihar district of Saran.
4. North-eastern region (Assam complex), covering Assam and adjacent sub-Himalayan regions.
5. Central eastern region (Bengal, Bihar and Orissa complex), covering the Chota Nagpur with its peneplains extending to West Bengal and Orissa.
6. Southern region, covering peninsular India.

The north-eastern Neolithic culture zone comprises Assam including Cachar hills, Garo hills and Naga hills. Neolithic implements were picked up from these regions from time to time for well over a century, the earliest record being that of Lubbock (1867) from upper Assam and Captain Beaching (1868) from Singhbhum. Many details have been filled in this sketchy picture during subsequent years but most of the data still comes mainly from surface explorations, although a few sites have been excavated in recent years. The excavated sites comprise Deojali Hading and Selbalgiri (Garo hills) in the north Cachar hills of Assam and Sarutaru and Marakdola on the Shillong plateau. However, keeping in view the geographical vastness of this area, the data is admittedly much too inadequate. Further, even these excavations were mostly of a vertical nature and we still do not have either a detailed picture

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of the life-style and economic background or a firm chronological base of most of these cultures. The artefact type and the corded pottery—seemingly associated with some of these cultures, find parallels with similar finds from eastern and southeastern Asia like the Neolithic cultures of Yangshao and Langshanoid of China and Hoabinhian of Thailand, but the chronological gap between the cultures of eastern India and those further east prevent a firm linkage and make possible interaction extremely difficult in the present stage of research. An attempt has been made in the following pages to present a synoptic view of the data against the backdrop of the Neolithic cultures in other parts of the subcontinent.

NORTH-EASTERN REGION

Assam

North-eastern India, comprising of Assam, Meghalaya, Arunachal Pradesh, Nagaland, Manipur and Mizoram, is one of the least explored regions of India, mainly because of the unfavourable climatic conditions with its torrential rain and impenetrable jungles. That this region is implementiferous was already known since the later part of the nineteenth century by the large collection by European scholars like John Lubbock, Godwin Austen, J.N. Hutton, J.P. Mills, G.D. Walker, C.R. Pawsey and J.H. Grace of ground and polished stone tools. In the mid-fifties attempts were made to locate these artefacts in their original stratified context, notably by M.C. Goswami in Assam and by T.C. Sharma in the Rongram and Sinasang river valley of the Garo hills. Among several sites of this locality, Selbalgiri, located on the terrace of the Rongram river, was briefly excavated by Sharma (Sharma, 1974:17-19). This excavation yielded ground and polished stone axes and pottery in the upper 60 cm deposits, below which only microliths were found to occur till natural soil was reached. The stone assemblage comprised of a flake and blade industry, a microlithic industry, a chipped stone axe industry, and polished stone industry occurring in association with a crude hand-made pottery.

Among other excavated sites of Assam, mention may be made of Sarutaru, a small hamlet situated 25 km southeast of Gauhati on top of a small hillock in the Kamrup district. Three trenches measuring 3 m each were excavated during 1967-73 to a depth of 65 cm, which resulted in the discovery of nine ground stone celts made on slate and sandstone and hand-made pottery having cord and basket impressions. This pottery is closely similar to that of Deojali Hading in North Cachar hills. The neolithic celts are of two types : shouldered and round butted.

Not very far from Sarutaru is the low mound of Marakdola. A small-scale excavation conducted at this site revealed a single cultural stratum of about one metre thickness from which were recovered wheel turned pottery of fine kaolin clay. This pottery was found at Ambari in the Guahati area which is assigned to a time bracket of the seventh century AD to twelfth century AD. The suspected date for the neolthic Sarutaru is the beginning of the Christian era.

The neolithic culture seems to have penetrated the hilly tract in the Himalayan foothills and neolithic stone implements have not only been reported from Assam but from North Sikkim as well as neighbouring Nepal. Exploration conducted along the Tista river and its tributaries in the Djangu area of North Sikkim have brought to light no less than eleven sites, viz., Lingthen, Lingdon, Barpak, Saukalan, Lingden, Gytong, Sangdeng, Guon, Torang, Gor-Taranol and Linkyong (Sharma, 1979-80, 82-83). The tool typology as well as the material are different, presumably in order to fulfil the local needs. The former comprise harvester, knife, axes, adzes and single and double perforated celts, mostly made of schist shale, and basalt. Some of these types like the double perforated celts are typical of this region and have

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affinities with the south Asian neolithic assemblage. The adzes, Honan knife, perforated celts and harvesters are typical of the South Chinese Neolithic assemblage (Sharma, 1985,52).

A similar assemblage has also been reported from Nepal by the Institute of Archaeology of Leningrad. Coupled with the discoveries from Assam and other north-eastern sites, the evidence definitely demonstrates cultural links with Southwest China and Southeast Asia (Sharma, 1985,52). Pottery is totally absent.

MID-EASTERN REGION

Bihar

Neolithic remains in Bihar come mostly from three geographical zones—the riverine plains to the north of the Ganga, (mainly Chirand and Chechar-Kutubpur), the foothills of the northern flanks of the Kaimur ranges, (Senuwar, distt. Sasaram and Taradih, distt. Gaya) and hilly regions of South Bihar. In the last-named area, Neolithic sites seem to be confirmed to high plateaus or terraces much above the flood plains of the river. They comprise chisels, rounded butt-axes and bar chisels made by chipping, picking, grinding and polishing techniques.

Chirand is a small village on the left bank of the Ganga in north Bihar. The site was under excavation between 1963 and 1970 but it was only during 1969-70 that, in the lowest deposit of two trenches (CRD-XI & CRD-XII) located on the eastern and western parts of the mound, a pre-metal Neolithic culture-complex was exposed (Sinha, n.d.). One of these trenches (CRD-XI) contains seven layers (12-18) which contain Neolithic deposits. The importance of Chirand lies in the fact that this site is located in low-lying plains with monsoon climate having alluvial soil all round brought by the rivers Ghaghara and Ganga. It seems that hunting and fishing were major occupations while rudimentary cultivation was also practised. The inhabitants cultivated rice, wheat, barley and lentils such as moong, masur and pea. Most of the animals were domesticated—humped cattle, Indian buffalo, sheep, goat and pig. Among the wild animals, rhinoceros, swamp deer and chital seem to have been hunted. A number of fish-bones and teeth and snail or mollusc shells suggest that fishing was popular. The tools comprise stone axes, triangular in plan with a rounded butt and convex cutting edge (very limited in number), pestles, querns, hammers and rectangular milling stones. The microliths comprise blades, bladelets, points and arrowheads but the most outstanding artefactual inventory contains a highly sophisticated bone tool industry, comprising the pick, burnisher, chisel, hammer, digger, weeder, bar-celt, shaft-straightener, side-scraper, end-scraper, needle, bodkin, toothpick, awl and arrowhead. Traces of post-holes exposed in the excavations indicate that the inhabitants lived in houses made of reed and mud which were circular in plan. They were conversant with the art of pottery making. Hand made vessels comprising bowls (lipped, perforated, footed, knobbed, etc.) and spoons, ladles and miniature pots of Black- and Red ware have been reported. The pottery was decorated with applique design, incised design, post-firing scratching and post-firing ochre painting. Black-and-red ware was produced in abundance in the succeeding Chalcolithic level of this site but the forms of the vessels were now different. Eight radio-carbon dates coming from the various Neolithic strata of this site fall between 1750 ± 155 (TF 1032) and 1270 ± 105 (TF1035) on the Libby half-life value of the carbon.

Another cluster of Neolithic settlements come from within a radius of 25-30 km on the Kaimur foothill in the Rohtas district. Exploration conducted during 1985-87 brought to light a number of Neolithic and Neolithic-Chalcolithic sites. Of these, the habitation site of Senuwar, situated on the right back of Kudra river was excavated for two field seasons (B.P. Singh, 1988-89) which resulted in the discovery of a pure Neolithic culture (Sub-period 1-A)

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which comprised cord-impressed pottery, rusticated ware and burnished red and grey wares along with microlithic tools. The microliths include bladelets, blades and flakes of chert, chalcedony and quartzite. The other stone artefacts comprise triangular celts of basalt, pestles, saddle querns, rubber stones and sling balls of various sizes. Recovery of carbonized grains shows that these early farming communities cultivated two crops a year, which included rice, barley, field pea and lentils. Presumably the inhabitants lived in huts made of reeds provided with well-rammed floors.

In the succeeding phase at Senuwar, copper makes it appearance in the form of fish-hooks, wire and needles. Its chemical analysis shows that the metal was brought from the neighbouring Rakha mines. The concomitants of this culture broadly remain the same as witnessed in the earlier sub-period 1-A. There is a marked improvement in the art of pottery making, particularly in its surface treatment. Post-firing ochre colour paintings present in the burnished grey ware vessels are reminiscent of a similar discovery from Chirand.

The lower levels of the upper sub-phase (1-B) has been dated between 1770 and 1400 BC by the radiocarbon method and hence the beginning of the earlier half i.e. sub-period 1-A) will go to the later half of the third millennium BC.

Besides, neolithic celts have also been reported from Manjhi, Chechar, Sonpur and Barudih. Among these, Chechar is located in district Vaisali, to the north of river Ganga in the alluvial plain. Excavation conducted by the Archaeological Survey of India at this site brought to light polished stone tools along with tools of bone and antler (*IAR*, 1977-78: 17-18).

CENTRAL EASTERN REGION

Bengal

In northern Bengal polished stone axes in small number have been reported from the Dungrabusti and Sindibong as also at Bagridibhi in Midnapore district; in the area of Susunia hill (Bankura district) and from several sites in Purulia. Ground stone tools have also been reported from numerous sites in Ajay, Kunoor and other river valleys of Burdwan and Birbhum districts and in the deltaic region of the Ajay and Bhagirathi. In addition to triangular axes noted above, the main tool types of Bengal are ringstone and shouldered celts. In the excavations of Pandu-Rajar-Dhibi located on the Ajay, some polished stone axes were reported from the earliest levels but an independent neolithic horizon at the site remains to be established. Similar tools were discovered in the excavation of Bharatpur in district Burdwan. A small-scale excavation was conducted at this site during 1971-72 (*IAR*-1971-72:50; 1972-73:36). Here a Neolithic-Chalcolithic culture comprising of plain and painted pottery, bone tools, neolithic celts, microliths and beads of semi-precious stones was found in the lowest level. The inhabitants lived in houses made of reeds and bamboo.

Orissa

The only excavated site in Orissa is Kuchai, situated about 8 km to the north of Baripada along the national highway to Keonjar. A small-scale excavation was conducted by Thapar in 1961-62 (*IAR*-1961-62:35-6). The upper clay deposit of 40-45 cm yielded polished triangular axes with rounded butt, faceted hoes, chisels, mace-heads, pounders and grinding stones. These artifacts were associated with a coarse grit-tempered red ware, sometimes also slipped and occasionally bearing incised or finger-tip decoration. The forms include bowls, and the *kunda*. It is interesting to note, in the adjacent territory of Andhra Pradesh, 15 sites yielding ground stone tools, along with microliths and pottery, have been reported in the coastal district of Visakhapatnam and East and West Godavari (Sundara, 1985: 45). Besides, evidence

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of domesticated rice was obtained from Baidyapur, a neolithic site in district Mayurbhanj. From the underlying deposit, composed of gravel mixed with greyish earth and loose laterite, microliths of essentially non-geometric industry was obtained. No pottery was found with these tools. In this context it may be recalled that recent field work in north-eastern Andhra Pradesh by K. Thimma Reddy (1985:54), covering Srikakulam, Vizianagaram, Visakhapatnam and East Godavari districts calls for a new definition of the Eastern Neolithic complex.

THE EMERGING PICTURE

The survey of the Neolithic cultures of Eastern India presented above indicates that Assam was a focal region of Eastern Indian Neolithic, while Bengal, Bihar and the eastern part of Uttar Pradesh seem to have been at the receiving end. As regards the basic tool types, there are two main traditions: the triangular axe with blunt butt end and the shouldered axe. While the shouldered axe tradition diffused along the coast into Orissa and northeastern Andhra, the triangular axe with blunt butt-end tradition diffused eastwards into Bihar and Uttar Pradesh.

It is generally believed that the ecological condition in Eastern India, particularly Assam, was not very different from that some three thousand years ago. Consequently, the life-style of the people was essentially similar to that of present-day tribal groups. The prohibitive natural conditions of the Brahmaputra Valley and the adjoining region have proved to be areas of relative isolation, mainly because the numerous hill ranges covered with thick evergreen forest. The rainfall is heavy and the land available for cultivation is naturally very small. The slash-and-burn method of cultivation is practised even today. Food is also supplemented by collecting a variety of tubes from the forest. A similar life-style has been envisaged on their neolithic predecessors as well. As regards the genesis of this culture, it is supposed to have derived its inspiration from South China and South-east Asia. Recent discoveries made in Sikkim further demonstrate cultural links with south-west China and south-east Asia. The adzes, Honan knife, perforated celts and harvesters are typical of south Chinese Neolithic assemblage. A similar assemblage has also been reported from south-east Asia. However, the evidences present in the Belan Valley seemingly point more towards indigenous development in the area. The cultures in the riverine plains of north Bihar and eastern Uttar Pradesh indicate larger dependence on agriculture and domestication of animals, while food gathering and hunting now assuming a subsidiary role. Evidence of rice cultivation is attested to by the impressions on pottery, presence of husk as a binding material in pottery and seeds recovered in the excavations. Some important sites with neolithic affiliation are Koldihwa and Mahagara in Uttar Pradesh, Chirand in Bihar, Kuchai and Baidyapur in Orissa. Rice cultivation was taken up in a big way by the succeeding Chalcolithic people as seen at Pandu-Rajar-Dhibi and Mahishadal in Bengal.

Discussion

Some noteworthy features of all the Neolithic sites taken together are discussed below. As far as ceramics are concerned, the earliest pottery is generally handmade. A few specimens produced on turntable have been recovered from Chirand and Taradih while at Senuwar wheel-made potteries are much more common than the handmade varieties. Generally the clay is now well levigated and the pots are ill-fired and of coarse and medium fabric, while plain red ware and cord-impressed pottery are generally found on all the four sites noted above, burnished red ware and burnished grey ware are confined to the sites of south Bihar only (Taradih and Senuwar). The now famous Black-and-Red ware has been reported only from Chirand where a large number of shapes have been noted, but it is significantly absent at the other three sites. With the onset of the Neolithic stage, prehistoric man settled at one place,

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the archaeological proof of which is manifest in the structural remains. There is evidence of a floor prepared below ground level at Chirand, which suggests the existence of some sort of pit dwellings. In the later phase (I-B) people started living in houses with mud-plastered reed walls on the ground floor. A circular, paved floor about 4 m in diameter was exposed in the second phase. A semi-circular hut with several oblong ovens, probably used for community cooking was also found. Outside this platform post-holes were located at regular intervals. A fairly large number of chunks of clay with reed and bamboo impressions found in these strata suggest that the houses perished in some conflagration. The remaining three excavated sites noted above, have provided only indirect evidence of building activities, which comprises burnt clay lumps with reed marks and floors made of rammed earth, suggesting the existence of wattle-and-daub houses as excavated at Chirand. Evidence of hearths comes from Chirand and Taradih only. The discovery of several oblong hearths in a semi-circular hut at Chirand has been noted above. An interesting feature of these hearths is that the soil around the hearths had become almost white in colour, indicating the presence of carbonates, calcium sulphates, salt or bone ash (calcium phosphate). From the white colour and the shape of ovens, it has been inferred that they were used for roasting animal flesh (Narain, 1970:24). A few hearths of different shapes and dimensions were also reported from Taradih but the details are not available. An insight into the technology of neolithic people of Bihar can be had from their ground stone tools, blade and microlithic industry and implements of bone and antler. The stone celts are exceedingly small in number and comparatively diminutive in size as well. Only four celts made of basalt come from Chirand. The triangular celts at Senuwar also made of basalt, generally of the small variety, are ground and polished all over the body. However, this inadequacy was more than made up by the discovery of a large number of ground stone objects presumably used for food processing (such as querns, pestles and rubbers), tool fabricators (hammerstones), fowling implements (sling balls) and other miscellaneous objects (discs). The use of microliths continued side by side, which falls in the category of Neolithic blade and microlithic industry. At Chirand, these tools comprise microblades, notched blades, arrowheads, points, lunates, borers and scrapers. In addition a few geometric microliths were also recovered from this site. All these tools are made of chalcedony, chert, agate and jasper and were manufactured from nodules probably collected from the bed of the Son river which flows not very far from the site and meets the Ganga at Harldi-Chapra, a few km south-east of Chirand. The lithic industry of Taradih comprises points, blades and cores and at Senuwar this industry includes blades, bladelets flakes and cores. At the last-named site, these tools were also made of quartz and quartzite, along with those of chert, chalcedony and agate.

An interesting feature of Bihar Neolithic is the occurrence of bone tools which have been recovered from all the four sites. Bone implements from Chechar-Kutubpur, Taradih and Senuwar generally comprise points and arrowheads but at Chirand, which has yielded about 200 artifacts of this class, they have been grouped in thirty varieties. They are made either from antlers or from long bones of cattle or deer. Some of the types comprise wedge, chisel, bar celt, weeding tool, hammer, knife, hide cutting tool, needle, spearhead, bodkin, tangled arrowhead, drill and shaft-straightner.

The personal ornaments recovered from excavations are beads made of semiprecious stones like chalcedony, agate, jasper, marble and steatite. The discovery of a number of unfinished beads from Chirand and Taradih indicates that they were locally manufactured. Other ornaments include pendants, ear-rings and bangles made of bone (from Chirand). Chirand has also yielded a number of terracotta objects like human and animal figurines, bird figurines and other miscellaneous objects. However, it is in the field of agriculture and other economic pursuits in which the Neolithians of Bihar had made significant advancement over their contemporaries from West Bengal. While rice was the main cereal content in the diet

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of Neolithic man in Bengal, at about the same time and even earlier agriculture based on two crops and even rotation of the crops had already been introduced in Bihar. Paddy-husk impressions were noticed on some burnt clay pieces at Chirand, but apart from these, wheat, barley, lentil (*moong, masoor*), field pea (*Pisum arvense*) have also been found. It is interesting to note that the wheat, barley and field pea (*Pisum arvense*) found here match the specimens found and recognized from Harappan and Chalcolithic sites in Western India (Vishu Mittre, 1972:18-22). Some leguminous weeds and wild fruits like ber have also been found. This data from Chirand has been supplemented by that coming from Senuwar. It comprises rice (*Oryza sativa*), barley (*Hordeum vulgare*), field pea (*Pisum sativum Vararvense*), lentils (*Lens culanaris*) and millets. In addition to this, the Neolithic deposit at Senuwar has also yielded dwarf-wheat (*Triticum-sphaerococcum*), grass pea (*Lathyrus-sativus*), kodan (*Paspalum scrobiculatum*) and seeds of vetch (*Vicis sativa*) which grows as a weed in the winter-crop fields. Thus the variety of crops at Chirand and Senuwar suggests that agriculture was the main source of the subsistence economy and both Kharif and Rabi crops were raised by rotation. Food was also supplemented by hunting, fishing and fowling. Animal remains have been found at Chirand, Taradih and Senuwar. At Chirand a large number of bone remains of sheep/goat, cattle, buffalo, deer, pig, elephant, rhinoceros, dog, bird, tortoise, fish and shell have been found. A large number of charred animal bones with hewn marks were collected from Taradih and Senuwar but their zoological identification is not yet known.

The chronology of Neolithic culture in Bihar is not clearly defined but some radiocarbon dates from Chirand and Senuwar give a fairly good idea about their chronology. There are ten radiocarbon dates from Chirand of which the earliest date (TF 1032) goes to 1760 ± 155 BC, which after calibration falls between 2195 and 1750 BC. There are six other dates which are progressively later than TF 1032; the latest in the series being TF 1035, which comes to 1270 ± 103 BC; which, after calibration, falls between 1575 and 1280 BC. The remaining three dates (TF 1036, TF 1126 and TF 1034) are later than 800 BC and thus obviously out of context. On the above showing, it is fair to suggest that Neolithic Chirand survived from *circa* 1800 to 1200 BC, WITH A MARGIN OF 100 YEARS ON both sides (Agrawal and Kusumgar, 1974:71). There is no C^{14} date from Senuwar from the pure Neolithic phase (Period IA). Three C^{14} dates 1770 ± 120 BC, 1660 ± 120 BC and 1500 ± 110 BC have come from the early phase of the Chalcolithic (Period IB) at this site (B.P. Singh, 1988-89:18). On the basis of these three dates, the beginning of Period IB, i.e. the Chalcolithic phase, has been dated to 1800 BC and hence the date of Period IA (pure Neolithic) will be definitely pre-1800 BC and its beginnings may as well go to the later half of the third millennium BC.

THE CHALCOLITHIC INTERLUDE

With the introduction of copper in limited quantity, eastern India, particularly Bengal and Bihar, witnessed gradual transformation from the Neolithic to the Chalcolithic stage. The Chalcolithic remains of Pandu-Rajar-Dhibi on the Ajay river in Burdwan district had been reported way back in the early sixties but recent years have witnessed the discovery of as many as 72 Chalcolithic sites in this region (Hoque, 1993). Of these, 33 Chalcolithic sites are located in Birbhum, 23 in Burdwan, 8 in Bankura, 7 in Midnapore and one in Murshidabad district. Geographically speaking, 47 sites are distributed in the *Rarh* plain, mainly concentrated in the Birbhum-Asansol *Rarh* and sporadically distributed in the Bankura *Rarh*. The distribution of these sites clearly shows that the Chalcolithic people of the lower Ganga valley preferred to settle along riverbanks, (the main rivers being the Dwarkeswar, the Ajay, the Rupnarayan, the Kunoor, the Damodar, the Kansabati, the Kopai, the Kumari and the Mayurakshi). These river valleys provided new and fertile alluvium after the end of the rainy season every year,

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where cultivation was possible even without ploughing. Another attraction was the abundance of aquatic fauna like fish (including carp), tortoise and snail. Of the 72 known sites, 12 have been excavated and a very brief summary of the results of these excavations is given below:

Mahishadal, situated on the left bank of the Kopai in the Birbhum district, measures 230 × 135 m. The cultural deposits of 2 m is divisible into two periods: (*i*) Chalcolithic; (*ii*) Iron Age. The Chalcolithic phase is represented by ceramics, remains of structures, copper and terracotta objects, microliths and charred rice (*IAR*, 1963-64; 59-60). From this site wild and cultivated strains of rice (*Oryza rufipogon, Oryza sativa*) (*IAR*, 1982-83: 150) were identified in carbonized grains from a barn. The barn as the calibrated radiocarbon dates suggest (Possehl, 1988: 186), was burnt down around 920-795 BC. Besides the date, useful data have been worked out from the size, volume and number of barns in the settlement (Ghosh, 1986). Among the domesticated animals, Bos *indicus Linnaeus* (Humped cattle) constituted the largest lot in comparison to buffalo, goat, sheep and pig. They also reared domestic fowls, pariah dog was quite common in this Chalcolithic village (Banerjee, 1981). The most notable copper finds at Mahishadal is a flat celt which has been equated with an axe type of the copper hoards (type IV-A) (Chattopadhyay, 1992: 61).

Bahiri, another village settlement, located 7 km east of the market town of Bolpur in Birbhum district is a cluster of three small mounds. Small-scale excavations conducted by Chakrabarti and Hasan brought to light three cultural periods: (*i*) Chalcolithic, (ii) Iron Age, (*iii*) Historical (Chakrabarti and Hasan, 1982: 111-24; Chakrabarti et al., 1978-79: 25-32). The Chalcolithic period is represented by pottery, structures, hearths, microliths, bone, terracotta and iron objects and animal remains. As regards metal objects only three very small copper fragments were recovered from trench BHR-7 which indicates its restricted use.

In the village Haraipur, district Birbhum, a small-scale excavation conducted by R.C. Kar (*IAR*, 1964-65: 46) revealed a 3.5 m thick deposit containing remains of Chalcolithic to Historical period. The Chalcolithic phase is represented by ceramics only.

The ancient settlement of Hatikra is located about 24 km north-west of Bolpur railway station in Birbhum district on the right bank of Dwarkeswar river. The ancient site spread over more than four acres was excavated by N.C. Ghosh and S. Nag (1986: 116). The excavation revealed a 2.55 m thick habitational deposit of continuous occupation from the Chalcolithic to the Iron Age. The Chalcolithic phase is marked by ceramics (black-and-red ware), mud floors, stone objects, terracotta objects and animal remains. The existence of copper is attested by two shapeless small nodules which, on examination, were completely turned into oxides having no core (Chattopadhyay, 1992: 58).

A small-scale excavation conducted at Nanur, located at about 20 km north-west of Bolpur in Birbhum district, has also revealed a culture sequence from Chalcolithic to historical times. The Chalcolithic phase is represented by ceramics only.

Bharatpur, situated on the left bank of the Damodar, about 7 km south-east of Panagarh railway station in Burdwan district, was excavated for four seasons (from 1971-72 to 1975-76). This excavation has revealed a sequence of four periods: (*i*) Chalcolithic, (*ii*) Iron Age, (*iii*) Gupta, and (*iv*) Pala. The Chalcolithic phase is represented by ceramics, structures, hearths, copper, stone and bone objects and microliths.

Barabelun, also known as Baneswar Danga, is located 29 km north-east of Burdwan town, on the bank of Khari river. A small-scale excavation conducted in 1974 revealed remains of three periods: (*i*) Chalcolithic, (*ii*) Iron Age, and (*iii*) Historical. The Chalcolithic period is represented by ceramics, microliths, and copper and bone objects.

The well-known site, Pandu-Rajar-Dhibi, is situated on the right bank of Ajay river in Burdwan district. It is an extensive site. It was intensively excavated for five seasons between 1961 and 1965 (Dasgupta, 1964; *IAR*, 1961-62: 59-62; 1962-63: 43-6; 1963-64: 61-2; 1964-65: 46-

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8) and again for one season during 1984-85 (*IAR*, 1984-85: 97-8). These excavations have revealed a sequence of five periods: Period I and II—Chalcolithic, Period III—Early Iron Age, Period IV—Late Iron Age, and Period V—Historical. The Chalcolithic phase is represented by the typical ceramics, structures, hearths, burials, copper, bone, stone and terracotta objects and faunal remains. After the excavation of 1984-85 vestiges of lower levels at this site were regrouped period-wise and now the earliest cultural phase has been designated as 'pre-Chalcolithic' on the basis of the presence of potsherds, a hand-made dull ware, charcoal specimens, Neolithic celts etc. A complete absence of metal was noted in this period. The succeeding Period II has now been divided into two phases viz., II-A and II-B. Both the phases have been designated as Chalcolithic (this sub-division contains the material of Period-I and II of the excavation conducted during the early sixties). The typical pottery is the black-and red-ware, both plain and painted; associated with plain red ware and a perforated red ware. It is in phase II-B that the appearance of iron has been noted and, on account of this, phase II-B has been designated as Ferro-Chalcolithic (De and Chattopadhyay, 1989: 65). This period was succeeded by the actual Iron Age deposit contained in Period III.

The ancient settlement of Mangalkot is situated on the confluence of Ajay and Kunoor rivers in Burdwan district, 30 km south of Pandu-Rajar-Dhibi. The ancient remains are spread over an area of about 2 square km. Excavation conducted by Amita Ray (1990:130-40) revealed a long history of occupation divisible into the following periods: Period I—Chalcolithic, Period II—Iron Age, Period III—Mauryan and Sunga, Period IV—Kushana, Period V—Gupta, and Period VI—Muslim. The Chalcolithic deposit is 2.5 metres and has yielded ceramics, structures, hearths, copper, iron, bone, stone and terracotta objects and plant and faunal remains.

The ancient site of Dihar is located on the bank of Dwarkeswar river, about 6 km away from Bishnupur town in the Bankura district. It rises some 7 metres from the river bed. Two seasons of excavation were carried out by A.C. Pal (*IAR*, 1983-84: 92- 3; 1984-85: 92-5). The cultural deposit of 2.5 metres has been divided into two Periods: I. Chalcolithic and II. Early Historical. Period I is characterized by ceramics, structures, copper, bone objects and microliths.

The ancient settlement of Tulasipur is situated just below the confluence of Kansabati and Kumari rivers in Bankura district. A small-scale excavation conducted at this site (Chakrabarti et al., 1982: 39-49; *IAR*, 1967-68: 49-50) revealed three cultural periods ranging from Chalcolithic to late Iron Age. The Chalcolithic phase is represented by ceramics, remains of structures and hearths and iron slag.

The site of Tamluk (ancient Tamralipti) has been known to scholars from quite some time. It is located on the right bank of the Rupnarayan river in Midnapur district of West Bengal. The site was excavated by M.N. Despande (*IAR, 1954-55: 19-20)* and subsequently by S.K. Mukherjee (*IAR*, 1973-74: 33) The cultural sequence is as follows: Period I—Neolithic, Period II—Chalcolithic, Period III—Early Iron Age, Period IV—Late Iron Age and Gupta. The Chalcolithic phase is represented by ceramics, a small polished stone celt and a variety of bone implements.

Discussion

An analysis of the cultural material obtained from all the 12 excavated sites listed above reveals that out of 12 excavated sites only four were inhabited in the early historical/Gupta times or later. The other sites generally have a two-period sequence and were deserted immediately after the early Iron Age, the possible reason(s) for which remains to be worked out. The main ceramic industries of the Chalcolithic cultures of West Bengal are the black-and-red ware and the red ware which are invariably present on all the sites. Besides, a kind of black slipped ware has been noted from 8 excavated sites, but it is absent from Nanur,

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Bharatpur, Tulasipur, and Tamluk. Similarly, red slipped ware is present at 6 sites but is absent at Bahiri, Hatikra, Nanur, Bharatpur, Barabelun and Tamluk. This absence of the last-named two wares is easily explained because the sites where these wares are absent are either only partially excavated or they represent comparatively insignificant settlements. In order to have a complete picture of the achievements of Chalcolithic folk of West Bengal, we have to rely on the evidence mainly coming from Pandu-Rajar-Dhibi, Mahishadal and Mangalkot which are comparatively large settlements and have been excavated on an appreciable scale.

The representative shapes in black-and-red ware are bowl, basin, jar and *handi*, which are invariably present at all the sites. Dish, dish-on-stand and channel-spout are the additional types in this ware which are present only at Pandu-Rajar-Dhibi and Mangalkot. All this pottery is wheel made and demonstrates a high degree of technical skill and sophistication in the manufacture as well as in firing technique. In the black-and-red ware simple bands, dots, dashes, sigmas, solid triangles, swastikas etc. were painted in white pigment on black surfaces. Some of the shapes, like the channel-spouted bowl, dish-on-stand, vase with perforation at the base may have ritualistic significance.

The inhabitants lived in huts and houses made of wattle-and-daub; the roofs were supported on posts and the floors were made of well-beaten earth with soling of rammed terracotta nodules and lime. Post-holes remnants of burnt clay chunks with reed impressions and floors were exposed in the excavations at Mahishadal, Bahiri, Hatikra, Bharatpur, Pandu-Rajar-Dhibi, Dihar and Tulasipur. The excavations at Pandu-Rajar-Dhibi shows that the houses were round, square or oblong in shape. Hearths were reported from Bahiri, Bharatpur, Pandu-Rajar-Dhibi and Mangalkot. At the last-named site hearths were found in a group of three together on the floor of the houses. The hearths contained charred bones, stone, saddle querns and a large number of potsherds. The presence of ashes on the floor of some of the houses suggests that there were frequent conflagrations which might have destroyed these houses.

A glimpse of the technological advancement of Chalcolithic West Bengal can be had from a close look towards the antiquities of copper, stone, bone and terracotta and the artifacts of stone. Among the copper implements, the discovery of a flat celt with convex cutting edge from Mahishadal and three fishhooks, one each from Mahishadal, Pandu-Rajar-Dhibi and Mangalkot may be mentioned. The celt might have been used for felling trees and cutting wood while the fish-hooks were obviously used for fishing. The copper/bronze objects found at Dihar (district Bankura) have been studied by Chattopadhyay who remarks that these objects bear close similarity with copper hoard objects of Akhuldoba, district Midnapur, West Bengal. Trace elements, as known through analyses are similar in the copper objects of both the sites. This in a way indicates that copper used in both the sites may have been obtained from the same mine. But the ore minerals in the Dihar copper object show the presence of oxide group, i.e. malachite-azurite, while the copper hoard objects from Akhuldoba were made from sulphide group, i.e. chalcopyrite. Even if we presume that copper used in the objects of both the sites came from the same mine, it still may be said that Akhuldoba copper hoard objects are comparatively younger (Chattopadhyay, 1992: 197).

Here it is pertinent to remark that iron was introduced in the upper phase of the Chalcolithic culture of West Bengal. Technologically, manufacture of iron from locally available laterite nodules was a significant advancement. The chemical and metallographic studies carried out on an iron dagger from Hatikra revealed that the metal under investigation was a low-carbon hypo-eutectoid steel (Ghosh, Nag and Chattopadhyay, 1989: 23). It seems at that time Birbhum along with other parts of the *Rarh* came in contact with North India. From several archaeological excavation sites, including Mahishadal and Bahiri, a new set of ceramics, generally found in association with the early Iron age in the upper and the

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middle Gangetic plain (Ghosh, 1986: 17) and remains of horse and camel are reported (Banerjee, 1981:197) from the same level.

The lithic industry of Chalcolithic West Bengal comprises ground stone tools and microlithic artifacts. Ground stone tools are limited in number; they comprise one axe from Pandu-Rajar-Dhibi and two small celts, one each from Bharatpur and Tamluk. The microlithic industry is better represented at Mahishadal, Bahiri, Bharatpur, Barabelun, Pandu-Rajar-Dhibi and Dihar. These comprise point-cum-scraper, flake with crested ridge, crescent, scrapers, various types of blades and cores. A solitary scraper made on fossil wood is an interesting find from Pandu-Rajar-Dhibi. Along with stone artifacts bone and antler tools also form an important part of Chalcolithic technology. They have been reported from Bahiri, Bharatpur, Barabelun, Pandu-Rajar-Dhibi, Mangalkot, Dihar and Tamluk. The types comprise points, arrowheads, anvils, awls, chisels, picks, and needles. While points and arrowheads were obviously used for hunting, scrapers were used for food processing, picks for cultivation, and awls, needles and chisels for manufacturing purposes. Terracotta net-sinkers and spindle whorls coming from Bahiri, Hatikra and Mangalkot were presumably used for fishing and weaving respectively. The discovery of a small number of beads of semi-precious stones, copper, shell and terracotta and bangles of copper and bone give an idea of the evolved aesthetic sense of the inhabitants. Beads of lapis lazuli, carnelian, agate and steatite provide indirect evidence of contact with other regions and long-distance trade. The religious belief of Chalcolithic folk is manifest in human burials which have been found in fractional or extended position or in urns. The burials are without furnishing. Nine burials were excavated at Pandu-Rajar-Dhibi. They fall into three categories: primary or extended; secondary or fractional; and urn burials. From Haraipur, 10 extended burials of children in north-south direction were exhumed (Ghosh and Chakrabarti, 1990: 210), their head lying towards the north and slightly inclined towards the west. Anthropological reports on them are still awaited. All these burials were probably within the habitation, as was a fractional burial of Period I at Pandu-Rajar-Dhibi (*IAR*, 1963-64: 59). The orientation of the body was uniformly east-west. For the urn burials large hemispherical bowls of black-and-red ware were generally preferred. The discovery of a terracotta phallus from Mahishadal, an enigmatic figure on a cube from Hatikra, channel-spouted and other ritual pottery forms and painted symbols on them give an insight into the religious beliefs of the Chalcolithic people.

There are several radiocarbon dates from the Chalcolithic levels of various sites. From Mahishadal two dates are from the early Chalcolithic (TF 391, 1690-1405 BC and TF 392, 1370-1035 BC) and one date from the Late Chalcolithic level (TF 390, 920-795 BC); one date from Hatikra (PRL 1191,1000 BC); one date from Bharatpur (PRL 15, 1770-1410 BC; PRL 187, 1545 ± 110 BC; PRL 188A, 1120-795 BC) and Pandu-Rajar-Dhibi (KN 3640, 1945 BC). Thus, the beginning of the Chalcolithic phase in this region can be placed around mid-second millennium BC. Radiocarbon date TF 390 from the late phase of Chalcolithic at Mahishadal indicates that the Chalcolithic culture lasted up to the latter half of the first millennium BC. Radiocarbon dates from Bahiri (PRL 866, 1000 BC), Bharatpur (PRL 188A), Hatikra (PRL 1191) and Mahishadal (TF 389, 690 ± 108 BC obtained from the early phase of Iron Age) also support this view.

This Chalcolithic culture thrived on agricultural economy which was primarily based on rice cultivation. Impressions of paddy husks from Pandu-Rajar-Dhibi were identified as those of cultivated paddy (*Oryza sativa L. graminae*) (Dasgupta, 1964:14). Burnt rice husks embedded in potsherds were also found at Mangalkot. At Mahishadal a large quantity of charred rice was found on the floor. Besides, two barns (circular pits) measuring 1.28 m in diameter and 1.25 m in depth were found at Mahishadal. These were probably used for storing foodgrains. Cereal food was supplemented by meat of nilgai, deer, goat, pig, humped cattle, buffalo, and

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freshwater fish. The faunal remains come mainly from Bahiri, Mangalkot, Hatikra and Pandu-Rajar-Dhibi.

As stated above, iron makes its appearance in the upper levels of the Chalcolithic culture. Iron slag occurring in Chalcolithic context has been recorded from Bahiri, Pandu-Rajar-Dhibi, Tulasipur and Mangalkot. At the last-named site some finished iron tools like arrowhead, point and spearhead were also found from the Chalcolithic levels. The iron objects from Pandu-Rajar-Dhibi were studied by Chattopadhyay (1991: 167-8) who opines that, because of the occurrence of iron in the upper level of the Chalcolithic period, it should be labelled 'ferro-Chalcolithic'. He believes that iron technology was prevalent in at least two different areas of this region, (*i*) the Sanjay-Suwarnarekha-Tarafeni Valley, and (*ii*) the Ajay-Damodar-Kunoor Valley. The radio-carbon dates from Hatikra (PRL 1191) and Bahiri (PRL 866) provide firm indication that iron technology was well established in this region around 1000 BC.

BIHAR

Recent excavations at Chirand and Chechar-Kutubpur to the north of the Ganga and Taradih and Senuwar in Southern Bihar provide ample data regarding the first Chalcolithic settlements in Bihar. As Senuwar is chronologically earlier than the other three sites, we first of all examine the evidence from this site.

As stated earlier, the earliest period at Senuwar is called Neolithic-Chalcolithic and is further sub-divided into two sub periods, viz. Periods I-A and I-B. Period I-A is devoid of metal and belongs to pure Neolithic while Period I-B is considered as Chalcolithic on the basis of the occurrence of metal objects. Period II is Chalcolithic and Period III witnessed the introduction of iron and NBPW. Period IV is ascribable to Kushana times.

The ancient settlement of Taradih has also furnished evidence of Neolithic-Chalcolithic settlements. This site is located on the bank of the Phalgu river at the foot of Barabar Hill, near the famous Mahabodhi temple at Bodh Gaya. It was under excavation from 1981-82 to 1985-86 (*IAR, 1981*-82: 10-11; 1982-83: 16; 1983-84: 12-13; 1984-85: 9-11; 1985-86: 7-9; Prasad, 1983: 138-9). Excavations have revealed seven cultural periods, of which the first two (Period I—Neolithic, Period II—Chalcolithic) are relevant in the present context. The Neolithic period has an average of a 60 cm thick cultural deposit consisting of ceramics, structures, hearths, ground stone tools, stone objects, microliths, bone tools, terracotta objects and faunal remains.

EASTERN UTTAR PRADESH

It is worthwhile to recall that a well-documented Neolithic culture is present on the northern slope of the Vindhyas. This culture was documented after the excavation of a number of sites like Koldihwa, Mahagara, Pachoh, Indari and Chopani-Mando, followed by exploration of more than 40 Neolithic sites identified in surface explorations in the valleys of the Belan, Adwa, Son, Rihand, Ganga, Lapari and Paisuni rivers by scholars of the University of Allahabad. The Neolithic people lived in thatched hutments having a covered area of about 15 square metres with well-laid-out floors. Remains of as many as 20 huts have been excavated from Mahagara. The cattle-pen exposed at Mahagara, with cluster of hoof imprints of cattle of different age groups gives an idea of the herding of animals by the Neolithic folk—cattle, sheep, goat, horse, deer and wild boar, of which the first four seem to have been domesticated (*IAR*, 1981-82: 10-11; 1983-84: 12-13). The botanical remains indicate that rice was widely cultivated in the area and rice husk was used as degressant in the pottery. The wild rice (*Oryza*

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nivera) from Koldihwa, Mahagara, and Indari and bone fragments of deer, antelope, bear and bird suggest that hunting and collecting of wild food was as important as domestication and cultivation. Rice husk used in the paste of the pottery shows that the rice belongs to a cultivated variety which, on the basis of the C^{14} dates obtained from the Neolithic deposits (seventh to fifth millennium BC, 6570 BC), provides the earliest evidence for rice cultivation in the sub-continent (Sharma, et al., 1980). However, doubts are being raised regarding the stratigraphic position of the three charcoal samples giving high dates (5440 BC, 4530 BC) and it is suggested that the charcoal comes from a fire-pit belonging to the pre-Neolithic strata. These views of Pal have been shared by Desmond Clark (Pal, 1986: 131) on the basis of his excavations at Kunjhun II in the Son valley of Madhya Pradesh. The other concomitants of Neolithic culture are ground stone tools (including celts), microliths and hand-made pottery.

The succeeding phase of development in the archaeology of eastern Uttar Pradesh is marked by several clusters of Chalcolithic sites like the Koldihwa-Kakoria group in the Vindhyas, the pre-NBP levels of Sringverpura, Kausambi (Period I), Rajghat, Prahladpur, Kamauli, etc. In recent years a new culture marked by a profusion of white painted black-and-red ware and designated 'Narhan Culture' has been identified on the type site of Narhan on the left bank of the Ghaghara in the Saryupar plain (Singh, 1994). This culture is also documented in the lowest levels of Sohgaura and Khairadih and a number of sites in Basti like Gulrihwa ghat, Lahuradeva, etc.

Our excavations have revealed that the Narhan Culture people were the first inhabitants of this region who cleared the area and made their first settlement of wattle-and-daub houses having well-laid-out floors and ovens, etc. The principal ceramic industry was white painted black-and-red ware which accounted for as much as 74 per cent in the lowest levels, but reduced to 58 per cent in the upper levels. The other associated wares are black slipped ware (typologically different from the usual black slipped ware associated with the NBP). Some of the sherds in this ware also have painted linear designs in white or cream colour. The other wares are red slipped and the ordinary red ware, some of which have linear painted design done in black colour. The economy of this culture was based on agriculture supplemented by hunting and fishing. Cereal grains of hulled and six row barely, club wheat, bread wheat, dwarf wheat, and cultivated rice have been identified. The pulses included pea, green gram/ chickpea and khesari besides mustard oilseeds and flax/linseed. Seeds of jackfruit found from these levels is an important discovery. Jackfruit grows wild in the western ghats and was taken to cultivation in north India. The present evidence suggests that the inhabitants of Narhan culture cultivated it for its fruit. Although the first settlers practised agriculture, meat was an important component of their diet as is evidenced from the presence of a large number of charred animal bones and antlers, some of them having cut-marks. In a limited collection of about 15 per cent animal bones excavated during 1984-85 from Period I, bones of humped Indian cattle, sheep, goat, remains of a wild ruminant like deer or antelope and horse have been identified. A significant omission is the total absence of the lithic component (microliths). Hence, the appellation 'Chalcolithic' cannot be applied to this culture (Singh, 1994).

The Narhan Culture can be dated between 1300 and 800 BC as indicated by the two radiocarbon dates of this site which read 1100 ± 110 BC and 1060 ± 110 BC. This is also confirmed by the two dates of Sohagaura and three dates from Khairadih coming from the corresponding levels. (B.P. Singh, 1987-88: 28-34).

After the discovery of 'Narhan Culture' some more field work was done and excavation was conducted for two field-seasons (during 1992 and 1993) at the inconspicuous settlement of Imlidih Khurd, located on the left bank of the Kuwana river, a tributary of the Ghaghara on the borders of Gorakhpur and Basti districts (Singh, 1992-93 and 1993-94). This excavation resulted in the discovery of an antecedent phase of culture stratigraphically occurring just below the Narhan Culture deposit hence termed as pre-Narhan with a suggested date of

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pre-1300 BC. This culture was represented by an essentially handmade corded pottery with various types of bowls, vases and *handi*-like cooking vessels as the principal types. The archaeo-botanical remains recovered from these levels (Saraswat, 1993) show that their vegetable food comprised cereals like rice, hulled and six row barley, bread wheat, dwarf wheat, jowar millet, pearl millet or bajra. The pulses include lentil, green gram, field pea and grass pea, while oil seeds included field brassica and sesame or til. This data has amply demonstrated that even during the first half of the second millennium BC agriculture based on two crops had taken firm roots in the Saryupar plain. The presence of jowar millet and pearl millet in Period I provides a glimpse of the import from beyond this region.

CONCLUDING REMARKS

(i) The evidences summarized above make it amply clear that the first settlements in Eastern India started with the onset of the Neolithic stage. However, it must be admitted that our knowledge regarding the Neolithic cultures is far from complete, mainly because of lack of systematic and sustained field work. The study of Neolithic cultures is largely confined to the typological study of stone tools and pottery. The reconstruction of life-style and the subsistence pattern of these people has not been possible largely because of lack of data and expertise. Archaeological data and osteological remains of animals have not been properly collected or studied. Similarly the climatic condition and ecological background of these cultures is still to be worked out.

(*ii*) The second problem is admittedly the very late dating of the Indian Neolithic as compared to that of similar cultures in South Western Asia or South Eastern Asia. Mehrgarh in the Kachi plain in Baluchistan is the only site whose beginning goes back to the seventh millennium BC and may be called a younger contemporary of early farming cultures of western Iran and the hilly flanks of Zagros. The two radiocarbon dates from Koldihwa in the Vindhyas fall between the time bracket of 6700-4500 BC but, as stated earlier, the charcoal samples in question are now said to come from pre-Neolithic strata at the site. Barring these two dates, we have more than fifty dates from as many as fifteen sites distributed all over the country and all of them consistently fall between 2400 and 1700 BC. What is the reason for such a late dating of the Neolithic in the sub-continent is far from clear. Are we dealing here only with cultural backwaters of the Neolithic? It is well-known that similar cultures in western Asia as well as in south-east Asia go back to the seventh-eighth millennium BC and earlier.

(*iii*) The introduction of metal (copper) witnessed a spurt of activities in every walk of life and a significant increase in the settlement. Hoque (1993, 154ff) has listed as many as 138 Chalcolithic settlements in the middle Ganga valley of which 110 are located in UP and 24 in Bihar. These sites are found below the 90 m contour line and are located on higher *bhangar* land which is above the flood level. These sites are almost always found along the river banks. Of the 134 sites, 13 have been excavated and a summary of the findings has been given above. The radiocarbon dates from Sohgaura, Khairadih, Narhan, Chirand, Sonpur and Senuwar indicate that Chalcolithic cultures were firmly established around 2000 BC on sites in Bihar and by about 1500 BC in the Saryupar plain.

(*iv*) In the lower Ganga plain as many as 72 Chalcolithic sites have been discovered, of which 47 are situated in the Rarh plain and 25 in the delta proper. Here also most of the sites are located along the river valleys. Of the 72 known sites, 12 have been excavated and their results have been outlined above. The radiocarbon dates from Mahishadal, Hatikra, Bharatpur and Pandu-Rajar-Dhibi suggest that the earliest settlements of this culture go back to about 1400 BC and they continued to flourish for the subsequent 500 years.

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(*v*) While the economic base of the Chalcolithic culture of the lower Ganga plain was mainly based on rice cultivation, the staple food of the Chalcolithic cultures of the middle Ganga plain (including the Saryupar region) comprised rice as well as wheat and barley. Here we find that the cultivation of two crops a year was already firmly established during the Chalcolithic period and almost all these cereals were being cultivated which were the staple food of the urban settlements of the Harappa culture in the north-west.

(*vi*) The radiocarbon dates from Neolithic-Chalcolithic sites of eastern India have conclusively proved that these cultures are a younger contemporary of the Harappa culture. The natural question arises as to whether they were in contact with this mighty city-civilization. The discovery of more than one hundred tiny beads of steatite from the pre-Narhan deposits at Imlidih Khurd and several steatite beads from Chirand do provide an indication of such a contact, but this remains to be firmly established by further research.

(*vii*) The discovery of well-established village cultures based on the cultivation of two crops a year by rotation method in eastern UP and Bihar demonstrates an uninterrupted cultural continuity uninfluenced by any external stimuli from about *c.* 2000 BC in Bihar and from *c.*1600 BC in the Saryupar plain. This discovery has exploded the popular theory that this part of the country was 'aryanised' by clearing dense forests only around the eighth to seventh centuries BC as proposed by some scholars while giving a historical explanation of the Videgha Mathava legend of the *Śatapatha Brāhmaṇa*.

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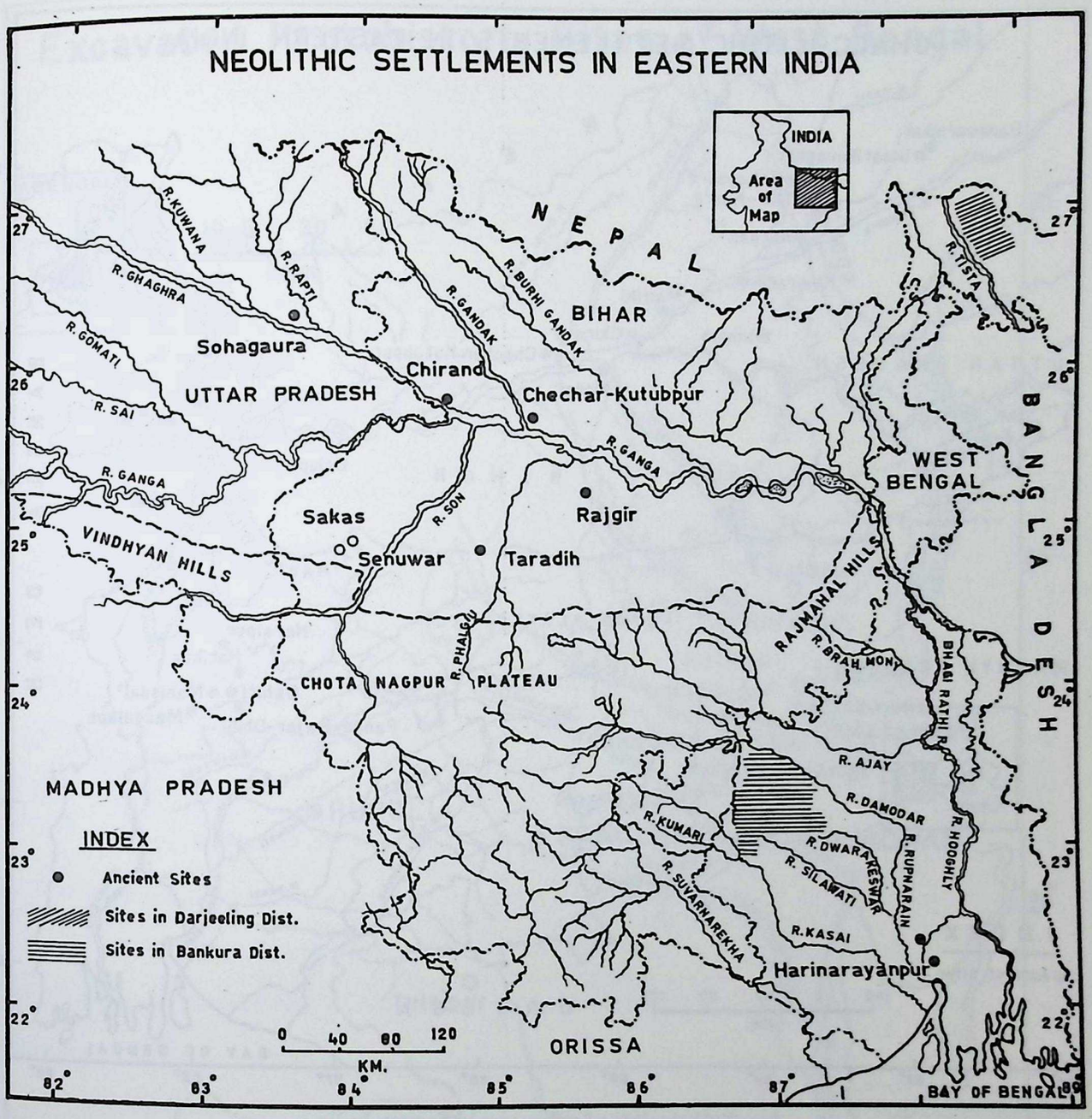

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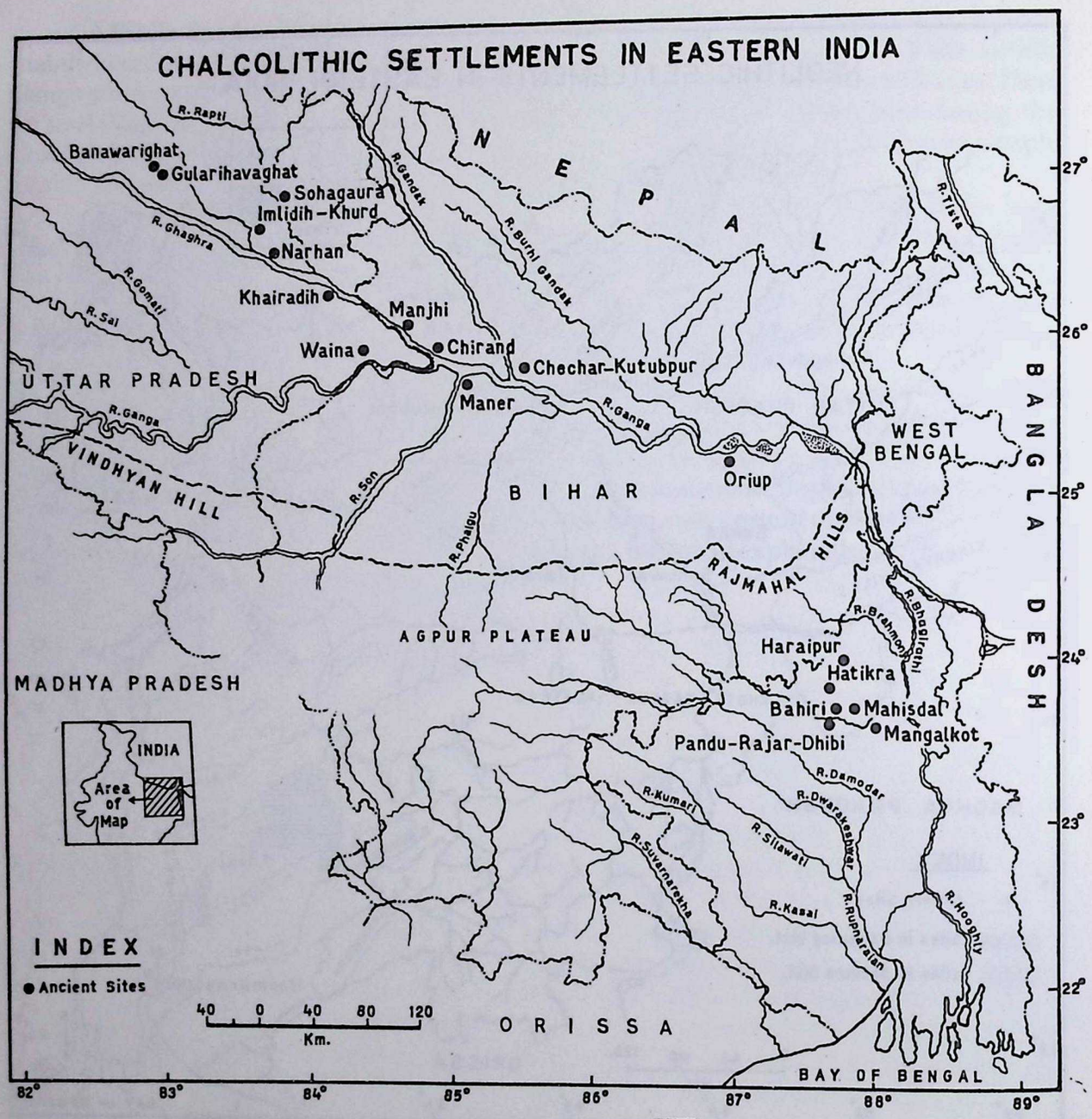

Fig. 2: Chalcolithic Settlements in Eastern India

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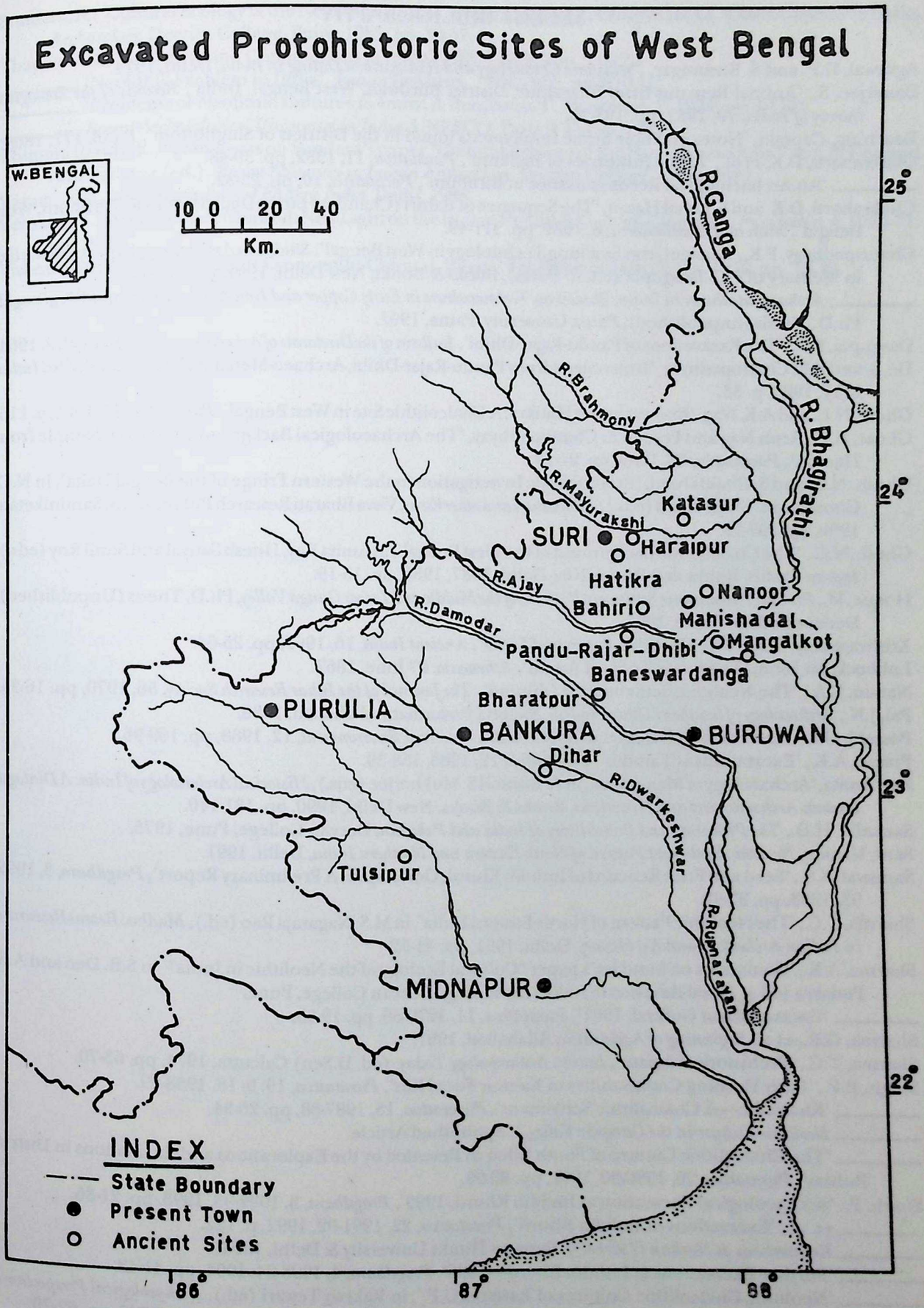

Fig. 3: Excavated Protohistoric Sites of West Bengal

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CHAPTER XVIII

Material Culture of South India as Revealed in Archaeological Excavations

K.V. Raman

One of the most significant developments in the historiography of ancient India in the recent decades is the volume of evidence that is growing on material culture provided by archaeological excavations. Thanks to archaeologists, we are able to delve deeper into our history and also proto-history and get some glimpse of the material civilization of pre-literacy society. Compared to the North Indian situation, South India is handicapped by lack of early literature like the Vedas, the Epics, and the Buddhist literature. Before AD 300, there is hardly any body of literature in South India which has survived, except the Tamil literature of the Saṅgam Period, much of which was rediscovered around the turn of this century. This literature is of exceptional importance for the reconstruction of political, social and cultural history of Tamil Nadu and Kerala in the early centuries of the Christian Era and we will have occasion to refer to it in greater detail later. But even this literary source is unfortunately lacking for the other parts of Southern India. This gap in our knowledge has been, to a certain extent, partly filled by archaeology.

The increasing volume of field work has brought into a better focus the developmental pattern of material culture in peninsular India right from prehistoric times and has also revealed many links with other parts of India and, indeed, outside India too. It covers the whole range of human activity and adaptation—arts and crafts, technology, agricultural practices, ceramic and other industries, house patterns, burial practices, metallurgy, coinage, emergence of script, religious beliefs, social practices and, above all, the ecological setting. The proper assessment of this body of evidence is of vital importance for any discussion on the broader issues like the social and state formations. Let us review this interesting body of evidence that has been unfolded by the spade and attempt to correlate it with the available literary and epigraphical evidence.

PRE AND PROTO-HISTORIC BACKGROUND

The antiquity of human life in the Deccan and South India goes back to Paleolithic times, as attested by the discovery of stone tools in the terraces of the river valleys, like those of the Narmada, Godavari, Krishna, Palar and the Kaveri. Man was a food gatherer at this stage and he used only crude stone implements like hand-axes and cleavers. On the basis of techniques and typology, archaeologists have recognized two tool traditions in India: the 'chopper'

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industries of the North (Sohan valley) and the bifacial handaxe—cleaver industry of the South. In many sites both the types are found together. On the basis of technique, the hand-axes have been called Abbevillo-Acheulian. The type-site Attirambakkam near Madras is well known. Several other sites with similar stone tools have also been located in the Godavari, Krishna and Tungabhadra valleys. Some of the important sites are Nagarjunakonda on the river Krishna (AP), Giddalur (Kurnool District of AP) on the basin of the Gundlakama river; and Karempudi on the Nagulerur (AP). One remarkable fact worthy of note is that the handaxe-cleaver tool groups found in South India show striking similarly to those found in South African prehistoric sites. At this stage, man was living on the open river banks or terraces where game was abundant and resources of flora and fauna and other necessities of life were available. Recently, evidence of these Early Stone Age men taking shelter in a natural cave has also come from a place called Gudiam near Attirambakkam on the banks of the Kortalayar (or Palar) near Chennai. Stone tools have been found on the floor of the large Gudiam cave.

The next stage in the pre-historic sequence is identified as the *Middle Stone Age* which was marked by the manufacture of flake tools from chert, which has parallels with the Levallois-Mousterian in West Asia, North Africa and Europe. Flakes are struck from prepared cores that are usually disc-shaped. Professor H.D. Sankalia has recognized seven types of tools for the industry like scrapers, borers or awls, points, scraper-borers, blade-like flakes, choppers, small handaxes on flint.[1]

Their distribution is widespread all over India, though more in North and north-western India and less so in Peninsular India. People continued to live on river banks and in rock shelters where they could get the raw materials for their tools. They continued to be hunters, using improved tool-equipment as it was developed over the centuries.

The next landmark in the sequence is designated as the *Late Stone Age,* earlier called the Microlithic or Mesolithic culture. Recent researches have revealed that this period witnessed the beginnings of settled life in India. Walter Fairservice Jr. described the period as a 'Prelude of settled life' and observes, The Indian Late Stone Age means full-fledged hunting and gathering in the sense of the Mesolithic of Western Asia and Europe. It also means a manipulation of local environment which could have led to food production.[2] Hundreds of these sites have been found in India like Langhnaj in Gujarat, Birbhanpur in West Bengal and a good many sites in Karnataka and Andhra. The Teri Sites on the south-eastern coast of Tamil Nadu are well known among them. The *teris* or the fossilized red sand dunes associated with the old shore line, marked by lagoons, is where the settlements of the microlith-using people have been found. Frederic Zeuner and Bridget Allchin, on the basis of the sea level correlation, have dated these sites to about 4000 BC i.e., in the post-glacial period called the Holocene.

Microlithic tools mark a great advance in tool-technology and typology. The teri microliths show a variety of points, lunates, arrowheads, blades, awls, triangles and end-scrapers, which indicate the diverse functions and activity for which they were used. They were made of quartz crystal. Other sites in South India show a variety of raw materials like jasper, chalcedony and agate, besides quartz crystal. With these, their tool repertoire increased to include the bow and arrow, the harpoon, the lance, fish-hooks, nets, the sickle and the composite tool by hafting blades and flakes to a long bone or stick. According to the latest view, this microlithic stage in its later phase could have witnessed the beginnings of settled life with components like primitive food production or even some domestication of animals, pottery making etc. which became more clearly established in the next phase, the Neolithic period. Some rock paintings attributed to this period have been located in places like Kuppagallu, Bellary and the Mahadeo hills.[3]

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MATERIAL CULTURE OF SOUTH INDIA DURING THE NEOLITHIC PERIOD: (*c.* 3000 to 1000 BC)

The Neolithic period has been widely recognized as marking the beginning of settled life in human history and hence archaeologists even use the term Neolithic Revolution. As far as South India is concerned, Bridget and Raymond Allchin have identified some stages in the development of the Neolithic culture and the beginning is traced back to 3000 BC, as seen in some of the ash-mound sites of Karnataka.[4] The second phase is datable to 2000 to 1700 BC, followed by the third phase from *c.*1700 to *c.*1000 BC. But there is remarkable continuity, with some minor differences, in the cultural equipment.

The important excavated sites of this culture are Brahmagiri, Sanganakallu, Maski, Piklihal, Takhalakotta, Hallur, Utnur, Kupgal, Palavoy and T. Narsipur in Karnataka; Nagarjunakonda in Andhra and Paiyampalli in Tamil Nadu. The carbon 14 date for the Neolithic phase at Paiyampalli is 1390 ± 200 BC.

The salient features of the material life of this culture may be outlined here. They used ground and polished stoneaxes made of black basalt or gneissic rock, besides the microlithic blades that marked this culture. The stone-axes and adzes must have helped them in their primitive mode of agriculture and other food productive activities. Dry cultivation was practised both at the foothills and on the flat terraces on the slopes. Horse gram, millet or ragi and green gram were cultivated. Their economy largely depended on cattle raising. Cattle were kept in huge pens in which dung accumulated to the height of several feet to be fired in a ritual. Several such ash-mounds were seen at places like Utnur, Kupgal and Piklihsal. Besides the humped cattle, goat and sheep were domesticated. Evidence of circular huts marked by dry stone walls and with mud flooring or cowdung and ash-mixed earth plaster has come from places like Tekkalakotta and Sanganakallu. Hearths, grinding stones and mullers have been found in habitation sites. These dwellings were not far different from the circular huts still used by poor villagers even today. Clear evidence of the use of pottery has come from the Neolithic sites. Burnished grey or buff pottery was used and the popular types were wide-mouthed jars and vases. A site named Pattupadu in Andhra Pradesh has yielded distinctive painted red pottery and channel spouted vessels.

Some interesting burial practices associated with the Neolithic culture have also come to light. They buried the dead in or near their own dwelling places in fully extended positions usually with grave goods like pots and in some earlier cases stone axes. A noteworthy type found in the graves in some sites like Nagarjunakonda (AP), T. Narsipur (Karnataka) and Paiyampalli in Tamil Nadu is the pottery headrests. This would imply that the Neolithic people had some belief in the life after death and the need to equip the grave.

Some evidence of the artistic or aesthetic activity of the Neolithic people is also available from a few rock paintings and bruisings found near their sites at places like Maski, Kupgal and Piklihal. Among the bruisings, those of Maski depicting long horned and humped bulls and wheeled carts are well known and impressive. The paintings were done in white Kaolin or red ochre. Here also the favourite subject was cattle in groups. Human figures with spears are also shown. In later phases, elephants and horses are also depicted. The figures show fidelity to nature and natural flow of lines.

Thus from the features outlined above, we can state that in South India settled life based on primitive agricultural, a food-producing economy with allied tool equipment, ceramic industries, cattle-rearing, domestication of animals, dwelling houses, distinctive burial practices, and primitive art forms were traceable back to the Neolithic period, starting from around the middle of the third millennium BC. Chronologically, it was contemporary partly with the Indus Valley Civilization but differed widely from it in many respects, the most important being that, while the former was essentially rural and non-metallic, the Indus

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Civilization was a full-fledged Chalcolithic society in nature, with advanced copper technology and consequent urban features like planned cities, public buildings, brick architecture, highly painted potteries, seals and sealings and pictographic script and writing. The Chalcolithic phase is not well marked in South India and scholars are of the opinion that the Neolithic culture prevailed longer there (with limited use of copper towards the end-phase) than in the north till the advent of iron in a big way around the middle of the first half of the first millennium BC. At many sites like Hallur and Paiyampalli, evidence of the Neolithic culture overlapping the iron-using culture without any break has come to light.

MATERIAL LIFE DURING THE IRON AGE (MEGALITHIC PERIOD)

The advent of iron brought about conspicuous changes in the socio-economic and cultural life in South India, as indeed it did in the rest of the subcontinent. A date ranging from 700 BC to AD 100, can be ascribed to it. In general, it spread widely by the middle of the first millennium BC, until it overlapped early historical periods like the Satavāhana rule in Deccan and Andhra, and the period of Saṅgam literature in Tamil Nadu. One of the problems in researches related to the Iron Age culture of South India is the dearth of evidence concerning their habitation sites. While there is quite an impressive body of evidence regarding their burial practices, the material evidence from their habitations is meagre. The evidence furnished by the excavations at places like Hallur, Brahmagiri-Chandravalli and Maski (Karnataka) and Kunnathur, Paiyampalli, Alagarai, Kodumanal (Tamil Nadu) may be presented here. However, it is through the excavation of a number of the Iron-Age burials, usually known as Megalithic burials, that we get an excellent picture of the material culture of the Iron Age people of South India.

Some salient features of the material life of the Iron Age people of South India, as gleaned from the burials and habitation sites, can be outlined here.

Houses

Evidence from the Paiyampalli site indicates that like their Neolithic predecessors, they also lived in circular houses with thatched roofs. Floors were made of stone chips covered with *muram* or plastered with lime. They lived close to river banks (as at Alagarai or Nattamedu) or lakes shores (as at Kunnathur or Rajakulipettai near Chengalpattu). They are found in the hilly and rocky areas like Salem and North Arcot (e.g., Paiyampalli, Chandrapura etc.), as well as the coastal plains in Tirunelveli (Adichchanallur).

Agriculture

Scholars are generally of the opinion that it was during this period that diffusion of irrigated rice agriculture began.[5] This is based on the circumstantial evidence of the location of the Megalithic burials on the slopes of the hill near lakes, e.g., at Rajakulipettai opposite to Kolava lake near Chengalpattu (Tamil Nadu) and the Kunnathur site near Sembarabakkam lake, and Sanur near Madurantakam lake. As observed by Clarence Maloney, 'Irrigated rice cultivation made possible a way of life somewhat different from that of the Deccan which depended primarily upon millets, grams, pulses, oilseeds, and cotton because over most of it only dry farming is possible.' According to him, it is likely that rice cultivation which had come into practice in the Gaṅgā region and Bengal in the early centuries of the first millennium BC spread through Bengal and the coasts of Orissa, Andhra and Tamil Nadu by the first half of the millennium.

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IRON TOOLS FOR AGRICULTURE, WARFARE, ETC.

The most important feature with far-reaching consequences was the knowledge and use of iron technology. The question of origin and spread of iron in India or whether it was indigenous or of extraneous origin need not detain us here. Dr N.R. Banerjee's considered view that iron working in India began as early as 1000 BC and became more common around 800 BC fits in reasonably with the evidence coming from the Gaṅgā-Yamunā Valley as well as that of Deccan and South Indian Megaliths.[6] The observation of the Allchins that in the Gaṅgā Valley, during both periods of Painted Grey Ware and the Northern Black Polished Ware (or the Iron Age) there was a build-up of population and a consequent increase in the cultivation of rice and an increase in the number of settlements may be applied with equal validity to South India also during the Iron Age. We observe the phenomenon that Neolithic sites are near hilly tracts and rarely in the plains while the Iron Age settlers are more widespread, including on the plains (e.g., the Kaveri valley). Irrigation, rice cultivation, iron technology and probably greater mobility due to the increasing use of horses, all contributed to the onset of urbanization. The iron tools found in the Megalithic graves of South India display a wide range of functions for which they were used; agricultural tools like the sickle, hoe, axe; weapons of offence like spears, arrowheads, javelins, daggers and swords; household objects like hooks, knives, ladles, saucer lamps and artisan tools like chisels, and nails. The occurrence of horse bits in many of the burials in sites like Kunnathur, Sanur, Adichchanallur, Brahmagiri etc., also indicate the increasing use of horses for swift movement and also the presence of the warrior class. Some paintings depict horse-drawn carts and mounted warriors. Full skeletons of horses have been found in the Megaliths of Vidarba.

OTHER METALS

Copper and bronze were rather scarce and their usage was on the whole limited. But their presence is clearly attested at Adichchanallur, Nilgiris and Kunnathur, etc. The former two have yielded a variety of copper objects. Alexander Rea has given a list of 123 copper objects at Adichchanallur.[7] They include bowls, jars, cups, sieves, flat dishes, frying ring stand, animal figures like the deer, dog, cock, bells, collyrium rods, finger rings, bronze necklaces, bangles etc. Interesting types are the lids with their tops designed like animals like deer, dog, buffalo, ram, and birds like the cock. Some bronze diadems were covered with gold leaf. The vessels had decorations like wavy lines and other geometric patterns. The bronze contained 23 per cent of tin. The Nilgiri copper objects also exhibit a high degree of craftsmanship in the form of a variety of bowls, lamps and bangles with designs. Here the bronze vessels showed an alloy with 29.89 percent tin. But the date of the Adichchanallur and Nilgiri burials is not yet clear; apparently they belong to the later phase of the Iron Age.

Gold and Silver

The practice of making gold ornaments was known though probably limited. A Megalithic burial at Suthukkeni near Pondicherry yielded a gold necklace. A few silver beads have also been found.

Metal Technology

The discovery of heaps of iron slag, furnaces etc., in innumerable Megalithic sites clearly indicates that iron was not imported but was locally manufactured. A furnace with iron slag was excavated *in situ* at a place at Guttur in Dharmapuri district by the University of Madras.

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Iron smelting, forging and fabricating techniques were widely practised. They also practised copper smelting and they knew how to make an alloy of tin and copper to make bronze.

Semiprecious Stones

Beads of semiprecious stones like agate, jasper and carnelian have been found in the Megalithic burials. Especially etched carnelian beads were widely used. Recently, hundreds of such beads have been found from the Megalithic site at Kodumanal, near Erode in Tamil Nadu. Some of them were locally made and some were probably imported from places like the Gulf of Cambay.

Shell Objects

Besides these beads of terracotta, shell and glass were also made. Discular shell beads with designs were found at Sanur. Conch-cutting was an important industry. Conch shells were cut and used as bangles or ear-ornaments.

Ceramic industry

The iron-age people had developed a high standard in ceramic industry. Wheel-made potteries in black, red and black and red ware were widely used. They were highly burnished and polished. An inverted firing technique was practised. One striking feature is the uniformity in technique and types or forms all over South India. This shows close social and cultural affinities. The variety of large urns and legged sarcophagi from burials, jars, with round or conical bases, bowls of different sizes, large and small dishes, lids, vases funnel-shaped vessels, ring-stands, simple and hour-glass types. All these would indicate a variety of usage, functions and refined tastes. The uniformity of forms show that it was a well-organized craft having a wide market network. The graffiti marks found in many of the pots are considered to be the marks of the potters or their guild. The marks commonly found from Hyderabad to Tirunelveli and Kerala are: the ladder, comb, loop, connected chevrons. They are found mostly singly but sometimes in clusters. B.B. Lal has shown how nearly 45 per cent of these symbols tally with those found in the Harappan and Chalcolithic cultures. He is of the view that they were the survivals of these cultures.

Burial Practices

As pointed out earlier, it is through the plethora of burial tombs or monuments called Megaliths that we know so much about the Iron Age people of South India. A fairly systematic ground survey, followed by a number of excavations spread over the southern States and even districts have helped us to obtain a fairly detailed picture of their burial practices and related architecture and rituals. Important sites excavated are: Perumbair, Adichchanallur, Kunnathur, Sanur, Amritamangalam and Kodumanal in Tamil Nadu; Brahmagiri and Chandravalli, Maski and T. Narsipur in Karnataka; Nagarjunakonda in Andhra Pradesh, and Porkalam in Kerala.

Though a variety of tomb types is found, they belong to a common megalithic complex.[8] The dead were exposed for excarnation and the bones were collected in parts and interred in the burial. The burials were of different types like large terracotta urns, or legged sarcophagi (simulating animals), pits dug into the earth, or stone chambers (cists), dolmenoid cists with port holes. In many cases these burials were covered with stone packing and marked off by stone circles. In numerous places (Madurai and Tirunelveli in Tamil Nadu, and Porkalam in Kerala), urn burials are found without the stone circles or appendage. In Kerala the burials are in rock-cut underground vaults. (e.g. Cochin). In Kerala two other peculiar types are found—tombs in the form of 'umbrella' stones (*kudai-kal*) and hood stones (*topi-kal*).

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Observing the striking similarities between the South Indian megaliths and those found in the West, like those in the lands bordering upon the Mediterranean and in the Caucasus, Palestine and Iran, scholars like Von Heimendorf and Gordon Childe have suggested possible maritime contacts and inspiration for the diffusion of the Megalithic burial practices.[9]

FROM MEGALITHS TO HISTORICAL TIMES— FROM PROTO-HISTORY TO HISTORY

It is interesting to note that the burial practices described above continued to be in vogue in the early centuries of the Christian era say till about AD 200 until, probably, they were replaced by the more uniform practice of cremation. The earliest available Tamil works usually described as Saṅgam literature, mention it as the prevailing custom.[10] One of the works described a vast burial ground on the outskirts of a town as full of thorny shrubs and buried urns where jackals and the owls abound, and where human flesh and bones are strewn about. The poem also has a verse addressed to a potter by a poet urging him to make a large urn worthy of use for the burial of the remains of a chieftain. The practice of burying in cist-chambers (*tālvayin-adaippōr*) and urn burials (*tāliyin-kavippor*) is alluded to in the epic *Manimekhalai.* These works reflect a stage when the old practices still lingered on just before they disappeared altogether giving place to cremation.

The above references from Tamil literature is important evidence that the Megalithic culture, especially in its later phase, was overlapping or merging with historical times. Exactly when this process was completed cannot be determined, but it coincides with the emergence of a script and, perhaps, the kingdoms also. The establishment of the Mauryan kingdom has been taken by scholars as marking the beginning of historical times in Northern India. Probably by about the same time chieftains and small kingdoms seem to have come to fore in South India also, the Satavāhanas in the Deccan and Andhra and the three kingdoms (Mūvendar) of Tamil Nadu—the Coḷas, the Pāṇḍyas, the Cēras (Keralaputras) and the Ādigamans (Satiyaputras) ruling in different parts of Tamil Nadu and Kerala. All the four lines of rulers mentioned are specifically cited in Aśokan edict No. XIII. It is well known that Aśokan minor edicts have actually been found in Andhra (Kurnool district) and Karnataka in places like Maski, Brahmagiri, and, more recently at, Sannati near Gulbarga. Scholars take them as evidence of the extension of Mauryan rule to the Deccan and South India. Since no Aśokan edict has been found in Tamil Nadu and Kerala, they were apparently outside the Mauryan empire. But there is evidence to show that the wealth of the Nandas and the mighty chariots of the Mauryas were known to the early Tamil poets (e.g., Mamulanar's verses in *Puranānūru*). Aśoka's missionaries were, however, active in spreading their Buddhist *dhamma* in Tamil Nadu and Sri Lanka. Moreover, the famous inscription of Kharavela of Kalinga speaks about his victory in his eleventh year of rule (*c.* 155 BC) over a league of Tamil states that was 133 years older than the date of the inscription. As observed by Professor Nilakanta Sastri, this shows that different states of the Tamil country could enter into enduring diplomatic relations and form a league against external aggression. This marks an important point in the process of State formation.

MATERIAL CULTURE IN THE EARLY HISTORICAL PERIOD UP TO *c.* AD 300

Some of the important or significant developments that took place in South India during the early centuries of the Christian era, and probably two or three centuries earlier, can be

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summed up here. As pointed out by Clarence Maloney, we see the emergence of all the characteristics of what the anthropologists call 'civilization'. It is generally characterized by 'urbanization, usually supported by a fully developed peasant economy specializing in cereals, permanent or monumental buildings, diversified economy, structured society, formalized religion, the state and writing.[11]

Cities and Buildings

As already stated, the process of urbanisation is traceable from Megalithic times. It included a sound agricultural base, and irrigation through rivers and tanks, which supported something more than a mere subsistence economy. This was further greatly improved and supported by the early kingdoms that come up in the rice-producing river valleys—the Coḷas on the Kaveri, the Pāṇḍyas on the Tambaraparani and Vaigai, and the Cēras on the Amaravati and Periar Valley, the Satavāhanas and their successors like Ikṣvākus in the Krishna valley in Andhra. The Tamil Saṅgam literature provides eloquent evidence of the care bestowed on agriculture and irrigation. Karikala, the best known of the Coḷas (*c.* second century AD) is hailed in the literature as one who cleared the forests and made the land fertile, strengthening the banks of the Kaveri, and also built a dam across the river (Kallanai), the remains of which are still to be seen. Archaeological excavation at Kaveripattinam, the port city of the Colas, at the mouth of Kaveri, has brought to light a well-built sluice and water reservoir of the first century AD. It was built of large-sized bricks with an inlet channel covered with a corbelled arch.[12] A similar water-tank of the second or third century AD was also laid bare at Nagarjunakonda.

Literary evidence, supported by substantial archaeological evidence, provides us with a long list of capital towns, port towns and other urban centres of South India that were focal centres of emerging political and economic power, trade and industry, religion and culture. places like Korkai and Madurai, the capitals of the Pāṇḍyas; Uraiyur and Kaveripattinam, the capital and port town respectively of the Coḷas; Vanji (Karur) and Muziri in the Cēra kingdom; Kanchipuram in the northern part of Tamil Nadu; Dhānyakataka (Dharanikota) near Amaravati, the capital of the Satavāhanas; Vijayapuri (Nagarjunakonda), the capital of the Ikṣvākus; Banavasi, the capital of the Kāḍambas in Karnataka, to mention only a few. Most of the cities were fortified and had well-laid-out streets with public and private buildings, including the palace, the temple or the stūpa, quarters for artisans etc. Madurai city, according to Saṅgam works, was made up of several enclosures which looked like a beautiful lotus flower. Excavations at Korkai, a coastal capital of the Pāṇḍyas yielded evidence of several industries like ceramics, pearl-fishery, conch-cutting, and processing of semiprecious stones, besides NBP pottery. The presence of NBP pottery this far south shows South India's contacts with North India in the closing centuries of the pre-Christian era.

Kaveripattinam or Pumpuhar located at the mouth of the Kaveri is eulogised in Tamil literature as a well-planned port city with harbour and warehouses on the coastal tip and the township with mansions and houses on the western side. Roman geographers mention it as a great emporium of trade. Excavations have revealed a massive brick-built jetty with wooden poles for anchoring boats. The structure is datable to about the first century BC/AD. Another impressive structure laid bare was a Buddha-Vihāra datable to the second century AD. On one of the rooms was found a lime-stone *Buddha-pada* showing clear evidence of contact with the Amaravati-Nagarjunakonda style.[13]

The excavations at the ancient capital city of the Ikṣvākus, viz., Vijayapuri (=Nagarjunakonda) in the Krishna Valley of Andhra Pradesh has perhaps yielded the most impressive parts of the city. Buddhist monasteries, stūpas and caityas and Brāhmaṇical temples with exquisite sculptures and inscriptions have been discovered besides secular

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buildings. Brick architecture and the art of stone sculpting were well developed. Private dwellings and a goldsmith's workshop were also exposed.[14]

Dharanikota (Dhānyakataka) was a fortified town of the Satavāhanas. Several structural phases and a wharf abutting on a navigational channel were discovered, besides Satavāhana coins and Roman potteries. Pliny mentions that there were thirty walled towns in Andhra.[15]

At Banavasi, the capital of the ancient Kaḍambas, portions of the ancient city, including vestiges of stūpas and a Buddhist complex have been laid bare. More recently, Sannati (Gulbarga District of Karnataka) has yielded an early Buddhist establishment besides traces of extensive fortifications. The discovery of Aśokan edicts (XII and XIV) indicates the Mauryan extension and the inscriptions and coins of the Satavāhanas show the importance of the place.[16]

Thus, in the first three centuries of the current era, there was a network of towns and cities especially in the fertile river valleys and the coastal plains. Some of them rose to be the capitals of a number of kingdoms in different parts of South India and even larger empires like that of the Satavāhanas. There were very good contacts between the regions and also with the Deccan and Northern India. Buddhist and Jain missionaries moved about freely in these States to practise and propagate their respective religions. Similarly, traders and trade guilds (*nigamas* or *srenis*) carried on trade freely in their regions and helped the flow of goods from one region to another. A Tamil work of the second century AD (*Pattinapālai*) gives an interesting list of articles imported at Kaveripattinam from different parts of India like the Gangetic plains, the west coast, and even foreign lands like Sri Lanka, Malaysia and the western world. Excavated findings lend support to this fact.

SCRIPT, COINS AND INSCRIPTIONS

The most important and epoch-making development was the emergence of a script and, consequently, of literature. Closely following the Aśokan inscriptions in Karnataka and Andhra cited above, we find the Brāhmi script being used for Prākṛt in those regions and even in Sri Lanka. Scholars have recognized a southern variety of the script, usually called the Battiprolu type. This was used by the Satavāhanas in their inscriptions and coins. In Tamil Nadu also the same script was used for writing the Tamil language, with suitable changes and adaptations. Iravatam Mahadevan designates it 'Tamil Brāhmi'[17] and some others would refer to it by the ancient name, 'Damili', that occurs as one of the scripts in the *Lalitavistara*. More than 75 short inscriptions have been found in natural caverns associated with Jains in Tamil Nadu in and around places like Madurai. Most of the caverns are associated with Jain ascetics undertaking *sallekhana*, austerity. In their inscriptions we get the names of the early Pāṇḍyan kings like Nedunjelian and Cēra kings like Ilam Kadunko and Atan Irumporai extending patronage to the Jain ascetics. That the script was not confined to the Jains but had wider usage, even among the populace, is seen in the numerous inscribed potsherds bearing Tamil Brāhmi inscriptions found in a number of excavated sites like Arikamedu, Uraiyur, Korkai, Kanchi, Alagankulam (near Rameswaram), Alagarai, Kodumanal—practically in all parts of Tamil Nadu.[18]

Coins

Another important discovery in recent years is that the same script was used in the coins and signets datable to the first and second centuries AD. Coins bearing the name of the Pāṇḍyan king, Valudi, the Cēra kings, Kuttuvan and Makothai, and a chieftain like Sendan (Andipatti hoard) have been found. All these facts attest to the widespread use of the Tamil Brāhmi script used in the Pāṇḍyan and Cēra royal inscriptions (e.g., at Mangulam and

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Pugalur), coins and potsherds of vessels used by the common people clearly attest to the widespread use of the script in Tamil Nadu. We find the same situation in Andhra also where the Brāhmi script is used in the royal records and the coins of Satavāhanas, Ikṣvākus and others. Coins issued by kings like Gautamī Putra Satakarni (AD 80-104), Pulumayi II, Śrī Yajña Satakarṇi (AD 170-199), with their names inscribed in Brāhmi script have been found.[19] Satavāhana coin moulds[20] were discovered in the Kanchi excavations. They were of Vaśiṣṭha Putra Pulumayi (AD 88-116).

By at least the first century AD, coinage had come into use in South India along with the time-honoured barter system. In the earlier periods South India also used silver punch-marked coins, as in North India. They were also locally manufactured as coin moulds of punch-marked coins were found in Kanchi. But later, different royal families issued coins with their own dynastic emblems. Square copper coins of the Pāṇḍyas from Madurai have their emblem of the double fish on one side and the elephant and the *aṣṭamaṅgalas* on the other. Similarly, Coḷa coins with their royal tiger emblem have been found at their port city, Kaveripattinam.[21] A large number of Cēra coins with their bow-and-arrow emblem have been found in their capital town Karur. One of them had the name Makothai and another the Kuttuvaṇ have been found. Both of them bare portraits of the king.[22] Some of these coins show the unmistakable influence of and affinity to the Roman coins which were pouring into South India from the days of Augustus and Tiberius (first century BC-AD).

MARITIME TRADE: ARCHAEOLOGICAL EVIDENCE

Roman Gold and Silver

Maritime trade with the western world was an important economic factor which enriched the material life of the people during the early centuries of the current era. The accounts of the classical writers like Strabo, Ptolemy, Pliny and the author of the *Periplus*, as well as the Tamil Saṅgam works are quite eloquent on this.[23] Archaeology has provided the tangible artefacts of the Romans (Yavanas) and we will draw attention to some of them here. The classical writers mention several port-towns and a few interior commercial towns as important places to procure the articles and products required by them.[24]

The chief articles of export from South India were: pepper and ivory (from Kerala); fine muslin (from places like Uraiyur and Mylapur) in Tamil Nadu, and Masulipatnam (Maisolia) on the Andhra coast; beryl (*vaidurya*) from the Kongu (Coimbatore) region; pearls and other semiprecious stones and few aromatic and luxury articles. They brought with them mainly gold, silver, wine and some rare gems and intaglios which were in great demand here. A Saṅgam poem tersely states that Yavanas came to Muziri (Kerala port) in ships with gold and returned with pepper. (*Ahananuru* 149 pp. 7-11) Hundreds of gold and silver coins (*auri* and *denari*) have been found in hoards from all parts of South India. The Roman gold must have accounted for much of the gold ornaments of South India. Gold jewellery with even Roman art-motifs have been found at Vellalur and Karur in Tamil Nadu.[25] Roman gold and silver coins were so highly valued that they were carefully hoarded. The hoarded Roman coins belong to several Roman emperors like Augustus, Tiberius, Claudius, Hadrian, Antonius Pius and Nero and their dates range from the first century BC to the third century AD.[26] There was so much of gold pouring into India that a Roman senator complained that Roman wealth was being drained into India, upsetting the balance of trade in favour of India. There is some evidence to suggest that Roman coinage influenced our coinage if not our monetary system. The silver coin, *dinara*, finds frequent mention in our monetary transactions as recorded in the inscriptions.[27] Perhaps they were valued for the bullion standard weight. A few imitation

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Roman coins have also been found. Recently, a Roman coin mould was discovered in the excavations at Talakkadu in Karnataka (A.V. Narasimhamurti, 1994).

Roman Wine and other Imports

Next to gold, it was the delicious Mediterranean wine that was in much demand in South India. A Tamil poem mentions how a Pāṇḍyan king delighted in drinking the wine of the Yavanas served to him in golden goblets by beautiful damsels. Excavations have brought to light Roman amphora jars in which the wine was brought and traded in India in coastal sites like Arikamedu (near Pondicherry), Karaikadu near Cuddalore, Alagankulam (near the Rameswaram coast), and Vasavasamudram (near Mahabalipuram) in Tamil Nadu.

Recent researches have shown that articles reached the Coramandal coast from different parts of the Mediterranean world like Italy, the Aegean Islands, Rhodes Island etc., and most of them are dated to the first century BC-AD.[28] Other Roman imports to South India included high-class ceramics like the Arretine or *terra sigilatta* and rouletted wares. The former was for limited use while the latter was widely distributed in South India, both coastal and inland. Local imitations of the amphora and the rouletted wares were also made. Roman gems, intaglios and lamps have also been discovered in South India in places like Arikamedu and Brahmapuri. This Roman trade with South India began to decline after the third century AD and, as a consequence, many of the early ports lost their importance.

South-East Asia

South India also had trade relations with South-east Asia. A Tamil poem (*Paṭṭinappālai*) of the second century AD mentions that the products of the Malay Peninsula (*Kālagam*) were reaching the port of Kaveripattinam. Possibly, things like tin, silk and cinnamon were imported. The poem mentions that horses came from across the ocean, possibly from Arabia. But archaeological evidence is lacking in this regard. Recently a square Coḷa coin of the first-second century AD and a touchstone with a Tamil-Brahmi inscription have been identified in the excavated remains in a site in South Thailand, showing the seafaring activities of the Tamils in this early period.

Textiles

As pointed out earlier, one of the chief articles exported from India was cotton fabrics. South India has a long tradition in the cloth industry. The fine muslin produced at Uraiyur (a suburb of Tiruchirapalli), the capital of the Coḷas, is specifically praised by Roman writers. Excavations in Uraiyur brought to light a brick-built dyeing vat used for dyeing cotton textiles.[29] Similar brick-built cisterns were also found at Arikamedu.[30] Other centres of the weaving industry were Madurai, Kanchipuram, Mylapur, Karur and Masulipatnam, many of which continued to be important as such even during the seventeenth and eighteenth centuries. Numerous spindle whorls and other accessories for making cotton yarns have been discovered in the excavated sites of South India. From contemporary literature, we learn of the use of silk garments too but archaeological evidence is lacking. There is some evidence to suggest that besides the local manufacture, silk was imported from China through South East Asia.

RELIGIOUS ARCHITECTURE AND SCULPTURAL ART

Excavated remains have thrown valuable light on the religious establishments and architecture. Brāhmaṇical religion as well as the heterodox religions, Buddhism and Jainism, had their own following. Well known Buddhist centres of Andhra like Amaravati, Nagarjunakonda,

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Goli, Salihundam and Jaggayapettah, have yielded impressive structural remains of Buddhist stūpas, caityas and vihāras. Both brick and stone architectural specimens display the high levels of architectural and artistic excellence reached. The stūpas in Nagarjunakonda show a variety of bases like *dharmacakra* and *swāstika*. Carved on lime-stone, the sculptures of the Amaravati and Nagarjunakonda schools are reckoned as superb productions and the forerunners of the classical art of India. In Nagarjunakonda, remains of temples of the Hindu deities like Aṣṭabhujaswāmī, Puṣpabhadraswāmī and Kārtikeya, besides a unique *aśvamedha* sacrificial site and a ceremonial tank have been discovered.[31] We know from other sources that the Satavāhana kings like Yajña Satakarni and Pāṇḍyan kings like Yāgasalai Peruvaludi and Coḷa kings like Karikala patronized Vedic religion and performed Vedic sacrifices.

As already pointed out, remains of Buddhist establishments have been discovered in other places too—Banavasi and Sannati in Karnataka and Kanchi and Kaveripattinam in Tamil Nadu which are datable to the first century BC-AD. Sravanabelagola in Karnataka was an early centre of Jainism but only epigraphical allusions to its association with Candragupta Maurya are available.

Thus these finds clearly demonstrate not only the religious conditions but also the architectural, artistic and aesthetic excellence reached in South India in the first three centuries AD.

Terracotta Art

The artistic excellence and aesthetic tastes of the people are also evident in the beautiful terracotta figures found in the excavated sites of South India like Nagarjunakonda, Dharanikota, Kaveripattinam, Kanchipuram, Uraiyur etc. Hand-modelled as well as moulded (single and double mould) terracottas representing human figures, mother goddess, cult objects, toys, and animals show a mastery of the clay medium. The terracotta figures of the Satavāhana artists challenge their counterparts in stone in their beauty and grace.

Literature

Before we conclude, a word must be said about literature, which is one of the hallmarks of a civilization. Though India has a long history of oral literary tradition, written records came comparatively late. This applies equally to South India. As pointed out in the beginning of this essay, the earliest extant body of literature is that what is known as the Saṅgam literature, usually ascribed to the first three centuries AD and possibly one or two centuries earlier. This corpus of literature has come down to us grouped in eight anthologies of 2279 poems of different lengths by 473 poets, including kings, merchants and women. The earliest Tamil grammar work, *Tolkappiam* also belongs to the same period.[32] This rich corpus of literature is of outstanding importance as a source of history and culture of South India. It is a veritable mine of information on the different facets of our culture—polity, social groups, customs and practices, religious beliefs and traditions, moral and ethical and philosophical ideas, trade and commerce, arts and crafts, and a host of other aspects. The rich data provided by this literature has to be correlated with the archaeological evidence described above in order to get a more integrated picture about the state of civilization of South India in early historical times.

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Plate. 1: Kaveripattinam: Excavated Wharf

Plate 2: Kaveripattinam: Façade of a Water Reservoir

Plate 3: Jaggayya Pete Reliefs, Low and Flat Fragmentary (Madras Museum).

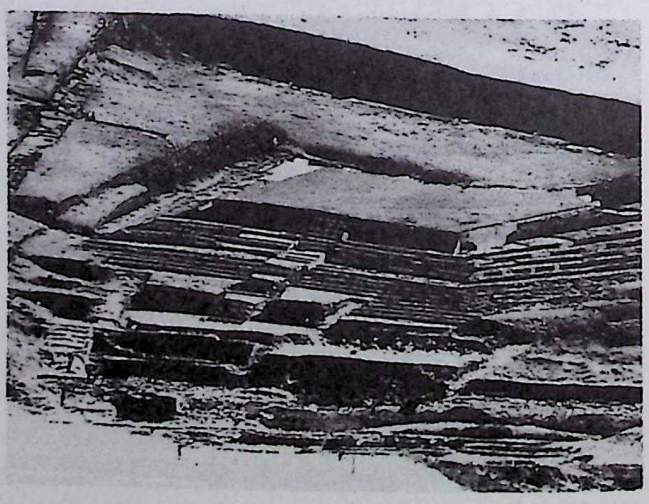

Plate 4: Nagarjuna Konda Stadium

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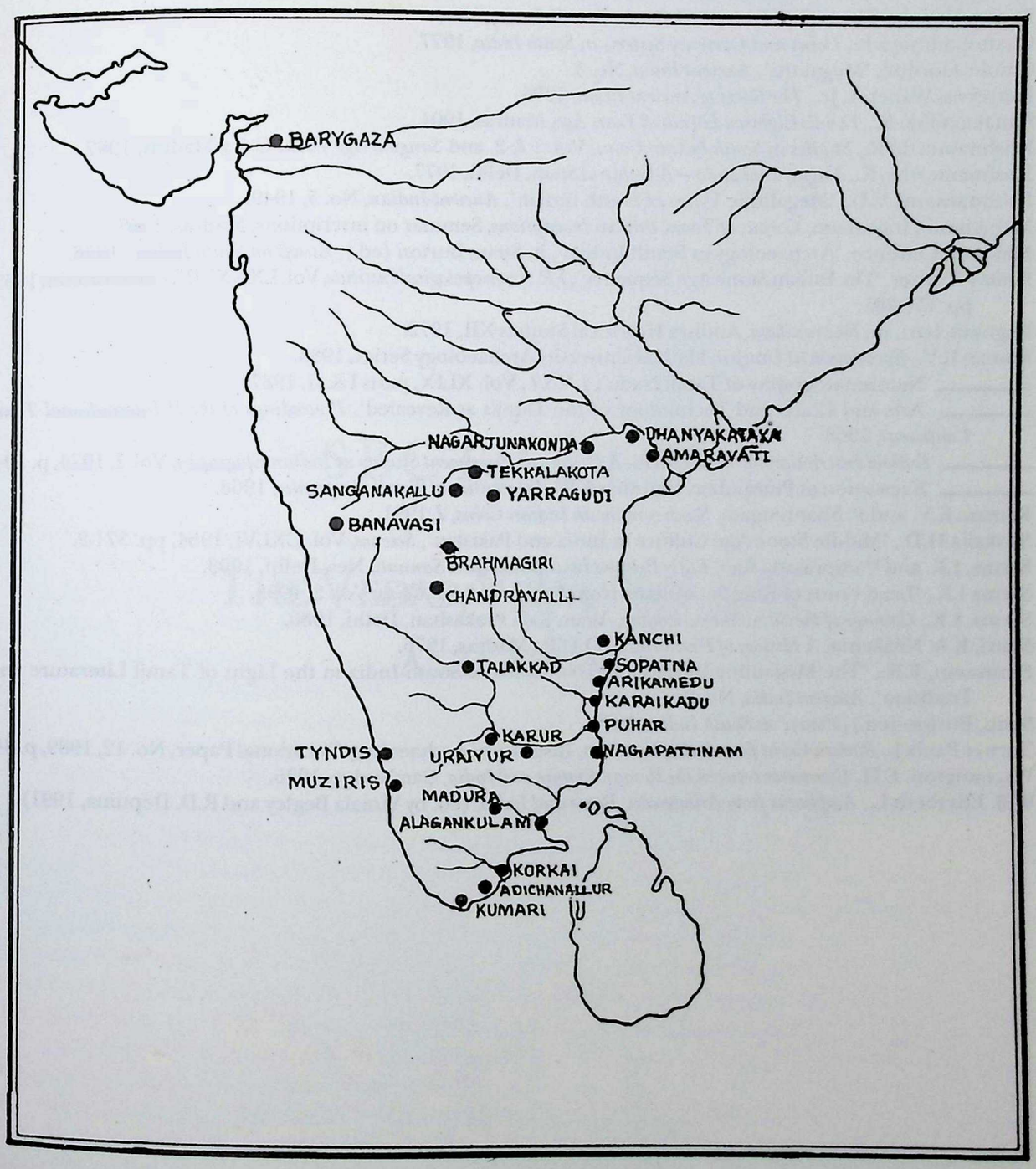

Plate 5: South India—Ancient Sites (mentioned in the paper).

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SECTION V

THE VEDAS, VEDIC SOCIETY AND IDEAS

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CHAPTER XIX

The Vedas, Their Authors and Significance

G.C. Pande

From ancient times the Vedas have been reputed to constitute an extensive literary corpus held in reverence as the source of all knowledge.[1] Thus Śaṅkarācārya describes it as 'the mine of all knowledge' (*sarvajñānākarasya*), 'lighting up all Truths like a lamp' (*pradīpavat-sarvārthāvadyotinaḥ*).[2] Patañjali had earlier indicated its traditional extent—'*Ekaśatam adhvaryuśākhāḥ sahasravartmā sāmavedaḥ ekaviṁśatidhā bāhvṛcyam navadhātharvaṇo vedah.* That is to say the *Ṛgveda* had twenty-one branches or recensions, the *Yajurveda* had one hundred and one, the *Sāmaveda* a thousand, the *Atharvaveda* nine. Most of these have now disappeared. Of the *Ṛgveda*, only one complete recension, that of Śākala, survives; possibly thirty-six hymns of the Bāṣkala śākhā are available and of the Vālakhilya only eleven. Of the *Yajurveda* only six recensions survive. Of these *Kāṭhaka, Maitrāyaṇī, Taittirīya*, and fragments of *Kapiṣṭhala-Kaṭha* recensions belong to *Kṛṣṇa-Yajurveda*. The *Śukla-Yajurveda* or *Vājasaneyīsaṁhitā* survives in the Kāṇva and Mādhyandina versions. Of the *Sāmaveda*, three recensions survive, viz., the *Rāṇāyaṇīya*, the *Kauthuma* and the *Jaiminīya*. Of the *Atharvaveda, Śaunaka-saṁhitā* is current, while the *Paippalāda-saṁhitā* is known.[3]

Each of the four Vedas constitutes a *saṁhitā* or collection of hymns (*sūktas*).[4] Each *sūkta* consists of a number of verses, or *mantras*. Their number in the *Ṛgveda* generally varies from five to ten though quite a few *sūktas* contain a greater or lesser number. The most ancient and original of the Vedic *saṁhitās* belongs to the *Ṛgveda*. It contains 1028 hymns (including the eleven *Vālakhilya* hymns) divided into ten *maṇḍalas*. It is generally accepted that the tenth *maṇḍala* is relatively later than the kernel constituted by the so called 'family *maṇḍalas*' i.e., the *maṇḍalas* from the second to the seventh. The first and the tenth *maṇḍalas* have exactly the same number of hymns, viz., 191. The 'family *maṇḍalas* are held to have been revealed to seers belonging to several distinct families. The eighth *maṇḍala* is known as the *Pragāthamaṇḍala* and its hymns were of use especially to the priests designated *udgātṛs*. The ninth *maṇḍala* brings together the hymns addressed to Soma.[5]

Each *sūkta* is specified with reference to its seer (*ṛṣi*), metre (*chandas*) and deity (*devatā*).[6] The themes of the hymns are diverse. They are often glorifications of the gods, recounting their characteristic names, addresses, myths, features and deeds. They contain petitions, recall ritualistic practices, applaud virtue and condemn vice. Sometimes they contain philosophical reflections or mystical intimations .Occasionally they present vivid pictures of nature or recount the munificence or glory of royal patrons. Rarely they contain charms for the cure of diseases or for other worrying circumstances.[7] On the whole, the hymns are sophisticated sacerdotal compositions valued for their wisdom and use in worship, especially sacrificial ritual in which certain *mantras* out of them were employed for the invocation of the

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gods, for making offerings to them etc. But they are not simply liturgical formulae, not mere folk poetry, nor any historical or legendary record of primitive tribal conflicts. Their value as a cultural document is incidental. Their primary value lies in their being the expression of Wisdom which is also the literal, meaning of the word 'Veda'. There is no other document in the history of civilization which is so ancient and yet in many ways so alive.

If the *Ṛk saṁhitā* was used primarily by the invoking priest or *hotṛ* in the course of ritual, the *Yajurveda-saṁhitā* was used by the *adhvaryu* who performs the ritual actions practically.[8] Of the 'Black' and 'White' versions of this Veda, the Black recension combines *mantra* and *brāhmaṇa* in one. Whether this is a sign of being earlier or later, is uncertain.[9] Of the *Vājasaneyī-saṁhitā* the sixteenth chapter in sublime praise of Rūdra is still widely read. Its fortieth chapter is the famous *Īśopaniṣad*. The *Yajurveda saṁhitā* is the major source of the ritualistic tradition.

The *Sāmaveda* is a collection of melodies sung during the *soma*-sacrifices. Although the word *sāman* has been sought to be derived from *sā* and *ama* in various ways, it signified a melody. As Jaimini says, '*Gītiṣu sāmākhyā*'.[10] The melodies were sung on verses largely drawn from the *Ṛksaṁhitā*. Only 75 verses of *Sāma* do not occur in *Ṛg*. The *Sāmaveda saṁhitā* consists of two parts, *Ārcika* and *Gāna*, the latter being really a practical handbook to *Sāma* singing. The former is again divided into *Pūrvārcika* and *Uttarārcika*, the latter into *Grāmageyagāna* (songs to be sung in the village) and *Āraṇya-geya-gāna* (songs to be sung in the forest.) The *Pūrvārcika* includes single *ṛcs* which served as the 'source' of melodies (*Yoni*).[11] These verses are 585 single stanzas which are sung to about double the number of melodies. The *Uttarārcika* has about 'four hundred chants, mostly of three stanzas each out of which the stotras are formed.[12]

The sections or *Kāṇḍas* of *Pūrvārcika* are—*Āgneya, Aindra* and *Pavamāna*. To these is added a *Pūrvārcika Āraṇyaka Kāṇḍa*. The *Uttarārcika* in 21 chapters carries the number of verses to 1875, including repetitions. This time, however, the verses are largely tristiches (*tṛcas*) though there are also distichs or *pragāthas*. The *stotras* were constituted out of the texts in the *uttarārcika* which is arranged in order of sacrifices, not the deities. If the *Pūrvārcika* gives the song cues to melody, the *uttarārcika* gives the song of which the melodies are presumed to be known. Where the *tṛcas* begin with a *ṛc* in the *Pūrvārcika* the melody for the former is the same as for the latter. The melodies are to be understood from the *Grāmageyagāna* and *Āraṇyageya gāna*. The *gānas* give the melodies by means of musical notation and the song-text in the form in which it is sung, that is with the changes in syllables with repetition and the additional syllables like *hoyi, huva* etc. called *stobha*. The actual order in which the melodies are employed is further specified in the *Ūha-gāna* and the *Ūhya-gāna*. The *Sāmaveda* is the source of the Indian musical tradition.

The *Atharvaveda Saṁhitā* consists of twenty *kāṇḍas* in which the contents show a wide divergence from the other *saṁhitās*. They included on the one hand, various hymns which relate to the prevention and cure of diseases, warding off natural and supernatural ills, the gaining of health, strength and success against rivals. On the other hand there are hymns which expound spiritual and cosmic principles as well as social institutions like Brahmacarya, Gārhapatyā, Vratyahood, Kingship, house-building etc. The *Atharvavedasaṁhitā* is, thus, a much more socially significant document than the other three *saṁhitās*. While its language and style give the impression generally of being later than the *Ṛgvedasaṁhitā*, that need not be true of some of its contents which belong to folklore.

Traditionally the Veda signifies not only the *mantras* or metrical hymns but also the *Brāhmaṇas* which are expository prose works and are almost commentarial in nature. They are connected with the Vedic *saṁhitās* and belong to different *śākhās*. Of the *Ṛgveda* we have two extant *Brāhmaṇas*, viz. *Aitareya* and *Kauṣītakī* or *Śānkhāyana*. The *Aitareya* has 40 chapters in eight *Pañcikās*. Traditionally it is attributed to Mahīdāsa Aitareya. *Kauṣītakī* has 30 chapters. Of the white *Yajurveda* we have the famous *Śatapatha Brāhmaṇa* in two recensions, *mādhyandina*

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and *Kāṇva*. It has 100 chapters in 14 *kāṇḍas*. Tradition ascribes it to *Yājñavalkya* but in the extensive chapters on *agnicayana* the authority seems to be *Śāṇḍilya*.[13]

Of the *Sāmaveda*, the extant *Brāhmaṇas* are the *Tāṇḍya-mahābrāhmaṇa* or the *Pañcaviṁśa-Brāhmaṇa* (as it has 25 chapters), and the *Jaiminīya Brāhmaṇa*. The *Ṣaḍviṁśa Brāhmaṇa* is complementary to the *Pañcaviṁśa*. The *Gopatha Brāhmaṇa* is ascribed to the *Atharvaveda*.

That the *Brāhmaṇas* are later than the *saṁhitās* is obvious because they take the latter for granted. This is also confirmed by the wider geographical horizon of the *Brāhmaṇas* as well as by their knowledge of not only copper and bronze but also iron.[14] But the *Brāhmaṇa* texts are not more homogeneous than are *saṁhitā* texts. Many of them are recognized to belong to relatively earlier and later periods.

Āraṇyakas were texts concerned with symbolic meditational worship, *vidyā, upāsanā, antaryāga*. Such worship appears to have begun with the *agni-cayana* and reflection over its symbolism. It developed into the meditation on the Supreme Being or Brahman. The Upaniṣads are concerned with *Brahmavidyā*.

According to the Brāhmaṇical tradition, the Vedas are eternal, divinely revealed and the tradition of their study is beginningless. The seers were those specially pure souls who were able to intuit the hymns of the Vedas. The philosophers of the Mīmāṁsā school believe in the self-subsistent eternity of the Vedas while the Naiyāyikas believe in their being revelations by God.[15] In both cases the Vedas are given to the seers, not authored by them. On the Mīmāṁsaka view, the Vedas are eternal as words or significant sounds; on the Naiyāyika view the words are not eternal but the wisdom they communicate is. Now the idea of a literal revelation, shared by many religions, is difficult to accept because the languages of revelation are obviously human and historical languages. On the other hand, there is nothing inherently implausible in the traditional belief that the Vedas give expression to perennial moral and spiritual wisdom provided one added 'as it became available to its seers within a certain historical tradition'. The Vedas, thus, may be regarded as the spiritual fountainhead of the Indian tradition. They express the vision from which philosophies and institutions, myths and motifs have been derived in successive ages in India.[16]

However, if the Vedas were traditionally held in reverence and regarded as the authoritative source of wisdom and law, they are now treated quite differently by the majority of 'modern' and especially Western scholars. From the days of Max Müller the Vedas have been subjected to critical examination by Western orientalist scholarship. While it has led to much advance in the understanding of Vedic language, its consensus is to generally debunk the claim of the Vedas to antiquity as well as to knowledge or wisdom. Vedic language has the richness, directness and flexibility of a living language, though it follows traditional hieratic models. While its accent and ritual use were carefully preserved in later times, its grammatical forms and idiom received only marginal attention in the classical period. From before Yāska to Pāṇini and Patañjali there was a vigorous study of the science and usage of language. Patañjali still regards a knowledge of grammar as necessary to the comprehension of the Vedas.[17] In the subsequent period, however, the Mīmāṁsakas developed a theory which regarded the Vedic hymns as simply liturgical formulae and injunctions. Their meaning was held to lie in their ritual use outside which lay simply what was called *arthavāda*.[18] Thus Sāyaṇa says, '*Arthajñānasya Yajñanuṣṭhānānarthatvāt*'. Sāyaṇa's commentaries are the best example of the classical ritualistic understanding of the Vedas.

It is with Max Müller's edition of Sāyaṇa's commentary of the *Ṛgveda-saṁhitā* that the history of modern Vedic criticism may be said to properly begin. Max Müller stated 'Sāyaṇa gives the traditional, but not the original, sense of the Vaidik hymns. These hymns—originally popular songs, short prayers and thanksgiving, sometimes true, genuine and even sublime, but frequently childish, vulgar and obscure—were invested by the Brāhmaṇas with the character of an inspired revelation, and made the basis of dogmatic theology.' He further

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states that the value of the Vedas lies in the light they shed on the archaic myths, ideas and institutes of the Aryan nations. Their value above all lies in their being the earliest linguistic record of the Aryan language. The value of the Vedas, thus, is historical, not poetical, and historical facts, he remarks, are to be valued as history, not for their intrinsic value.[19]

The modern study of Vedic language has been advanced by a distinguished galaxy of scholars. The works of Brugmann, Wackernagel and Macdonell summarize the modern analysis of Vedic grammar. Bohtilingk and Roth, Grassmann and Mayrhofer's works present modern Vedic lexicography. Max Müller, Oldenberg, Ludwig, Geldner and Whitney's works exhibit the achievement of modern scholars in the field of translating the Vedas into modern Western languages. The works of Macdonell and Keith, Bergaigne and Renou, Bloomfield and Hillebrandt, Oldenberg and Winternitz summarize the results of modern scholarship on the interpretation of Vedic religion, mythology and history. Many Indian scholars like B.K. Ghosh and R.N. Dandekar have added footnotes to this tradition of Vedic scholarship.[20]

While the use of comparative grammar, comparative mythology and comparative religion is of great suggestive value, it is not definitive and can be highly misleading if used with unproved or implausible assumptions. The net result of the proposed modern Western translations of the Veda is to reduce it to historical documents, confirming unproved hypotheses about the early history of the so-called Aryan race and, at the same time, to rob it of all serious poetical, philosophical and religious interest. In other words, this modern Western approach suggests that the Indians have held the Vedas in reverence through the ages in vain.

In reaction to this, some Indian and even foreign scholars have attempted to study the Veda in the light of some ancient traditions deriving from the Vedas, the *Nirukta*, the *Purāṇas* and some commentators. Swami Dayananda was the foremost among these and his tradition has been ably followed by Yudhisthira Mimamsaka. The *Vaidika Padānukrama Kośa* published from Hoshiarpur remains a monumental work, now indispensable for all Vedic scholarship. Sri Aurobindo's *Secret of the Veda* seeks to bring out the esoteric and mystical meaning of the Veda,[21] Kapali Sastri's *Siddhāñjana-bhāṣyam* and Anirban's *Vedamīmāṁsā* carry forward Aurobindo's tradition of Vedic interpretation. Frawley's works seek to bring out the wisdom of the Vedas. The Jaipur school of Vedic interpretation started by Madhusudana Ojha was ably advanced by Motilal Shastri and Giridhara Sharma Chaturvedi. Coomarswamy has used his unrivalled knowledge of diverse languages and traditions to unravel the deeper and symbolic meaning of the Vedas.[22]

Modern Western scholars generally take the literal meaning of the Vedas and understand it in the light of the hypothesis that it belongs to a context of priestly ritualism within an ethos of primitive thought and superstition. In contrast to this is the approach of those modern Indian savants and scholars who seek to discover in the Veda intimations of profound spiritual wisdom. Just as Western scholars rely on literal meanings and anthropological data, these Indian scholars rely on symbolism and later traditions and interpretations. In this situation many Indian scholars today tend to adopt a via media which recognizes that Vedas are profound and trivial in parts. So K.S. Murty says. 'Only by tortuous interpretations it can be shown that the entire Veda is through and through monotheistic, mystical or spiritual. Profound and eternal metaphysics and psychological truths and ethical intuitions of unsurpassed and perennial value as well as baseless beliefs and untenable ideas are to be found in it.'[23]

That the corpus of Vedic literature is vast and heterogeneous is uncontested. Its overall evaluation, however, must await further researches to determine the meaning and character of each part of the Veda. Already in the days of Yāska, there were alternative interpretations of the Vedas. If Yāska's method was etymological (*Nairuktika*) others belonged to the *Aitahāsika* or *Yājñika* schools.[24] It was held by some that the meaning of the Vedas is

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multidimensional, it could be *ādhyātmika, ādhidaivika, ādhibhautika* or *ādhiyājñika.*[25] The first of these comprised psychological and metaphysical meanings. The second comprised celestial or cosmological meanings. The third really referred to social phenomena, the word *bhūta* having the sense of 'beings', not matter.[26] The last class of meanings referred to ritual, which in turn had symbolic significance. Symbolism is ubiquitous in the Vedas and that should cause no surprise since the communication of superhuman truth is necessarily symbolic and no system of worship is possible without the use of symbolism of some kind or other.[27]

This deep fact of symbolism may, however, be obscured by various factors. In the Brāhmaṇas one meets with frequent reflection over the significance of ritual details. In the system of Mīmāṁsā which was originally designed to help the systematization of ritual, as also to formulate principles for the interpretation of Vedic texts, such reflections are disregarded as mere *arthavāda.*[28] Vedic orthodoxy has followed the Mīmāṁsā system to believe that the Vedas have no meaning except ritual and the ritual is nothing except those practices which are performed not for any natural or rational justification but simply because they are enjoined in the scriptures and may be presumed to have some transcendent result. This doctrine of the Mīmāṁsā, which regards ritual action as Dharma *par excellence* and the Veda as consisting simply of sentences prescribing ritual, is itself a later development and cannot be proved to be any original Vedic doctrine. Its notion of action as the sole purpose of the scriptures (*Kriyārthatvād āmnāyasya*) and leading to transcendent results is a particular post-Vedic dogma which seems to weave several philosophical insights into a whole designed to glorify the work of the priestly profession. The *saṁhitās* thus have been virtually hijacked from the realm of *Jñāna* and Bhakti.[29]

The Vedāntins questioned the absolute validity of the Mīmāṁsā ritualism and argued that the Veda teaches about Dharma as well as Brahman.[30] In the *Brāhmaṇas* themselves one can see how reflection over the significance of ritual acts culminates in the Upāsanās where knowing is the real thing, not doing. Kapali Sastri has argued that *Antaryāga* constitutes the essential or hidden meaning of the Vedic hymns.[31] Coomarswamy too has effectively utilized the intimations in the *Brāhmaṇas.*[32] Basing himself on *Vyākaraṇa* Dayananda explains the meaning of the Veda in a rational monotheistic manner.[33] Taking his cue from the Nirukta and the *Brāhmaṇas* Aurobindo has interpreted the Veda as the expression of mystical experiences. Madhusudana Ojha starting from the Brāhmaṇas has understood the Vedas as a cosmological science.[34]

If *ṛṣi, chandas* and *devatā* identify the Vedic mantras formally, their meaning revolves round the *Devatās* and their laws (*ṛta, dharma*). Modern scholars have used a number of concepts to elucidate the nature of Vedic gods. Tylor had propounded the theory of animism to explain the primitive belief in spirits and gods.[35] Animatism made the explanation even cruder.[36] In the Vedic conception of gods like the gods of the sky, or the sun, or fire, the conception of a spirit animating the natural phenomenon is joined to anthropomorphic imagination, though the degree of anthropomorphization is variable and never so complete as in the case of the Greek gods. Sometimes the gods are conceived theriomorphically. Some gods preside over separate departments of life and have been called *Sondergötter.* There is evidence for fetishism too.[37]

An ancient classification divides the gods into those of the sky, air and earth.[38] Among the celestial gods are Dyaus or the sky as father god, and many solar deities such as *Sūrya, Savitṛ, Pūṣan,* the Aśvins, Dawn *(uṣas).* The Ādityas, Viṣṇu, Varuṇa, Mitra and Vivasanī are other solar gods. The gods of the atmosphere include Indra, Apāṁ Napāt, Vāyu, Parjanya, Rudra and the Maruts. Terrestrial gods include Agni, Soma, Bṛhaspati, the earth, and the waters as rivers and the sea. There are some abstract gods like Prajāpati, Manyu, Śraddhā or Kāla. Some gods are dual, such as Varuṇa and Mitra, some form groups such as the Ādityas or the Maruts.[39]

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Of these the pre-eminent gods are Indra, Agni and Soma, though Prajāpati, Viṣṇu and Rudra assumed much importance in later Vedic time[40] Indra is the god of power but came to be associated with rain in later times. He is the leader and commander, the hero who destroys the demons, especially Vṛtra. Agni is the priest, the mediator between men and gods, the chanter and inspirer of hymns, the wise father and teacher, the lord of home and hearth. Soma originally referred to a plant with a brown and exhilarating fluid which was held to be particularly dear to the gods. It was itself raised to the status of a god and was held to be King of Brāhmaṇas. Soma sacrifices were associated with the chanting of Sāma or sacred melodies.

Basically, thus, the gods were conceived as anthropomorphic spirits of superhuman power governing natural or human phenomena. It would seem to be an essentially polytheistic view, though the similarity of many general characteristics in the gods and the search for classifying and grouping them, as also the tendency to exalt each above the others on the occasion of its special worship, gradually led to the perception of their unity and thus the Vedas occasionally have monotheistic utterances. Such is the normally accepted view of the evolution of the idea of God in the Vedas. The traditional view, however, sees no conceptual evolution, though it recognizes the divinity of gods worshipped by different people in different ages. The concept of the *devatā* arises from practical religious experience which is constant and abiding.

This interpretation of Vedic religion has certain general presuppositions. The first is that there is a quality-difference between revealed religions and primitive religion. The claim of Vedic religion to be based on intuition is set aside and it is assumed that the anthropological theories of primitive religion should apply to it. The second assumption is that the Vedic religion is to be primarily understood as the product of imagination and fancy moved by fear, superstition and wishful thinking, though it may contain occasional elements of natural piety, moral fervour and speculation about the beginnings of man, society and the cosmos. The third assumption is that the religion was dominated by the priestly assumption of magical power in certain words and rites, which formed the basis of the idea that the Veda is the holy word. The fourth assumption is that Vedic worship believes in the magical efficacy of material sacrifices which could appease gods who could thus bestow material favours on worshippers.

In the light of the Indian tradition of the science and philosophy of religion, the notion of *devatā* has to be differently understood. The Devatā is neither a linguistic poetic fiction nor an animistic misconception of natural objects, nor a primitive misunderstanding of the monotheistic God. It is a superhuman reality intuited by inspired seers and capable of responding to the worshipful human heart (*dhī*). Mantra, or the intuitive word, is its characteristic expression. *Devatā* is said to be so designated because of its luminous character.[41] Since light is that which creates and makes known it functions at the cosmic as well as the psychic level. It is the power creating and regulating natural phenomena and the source of paradigms for human behaviour.[42] It manifests itself in conscious as well as unconscious being.[43] The *devatā* or *deva-tattva* is the eternal principle of light (*jyotiṣ*) and Right (*Ṛta*) intuited and formulated by the seers diversely through the ages as diverse *devas*.

Since it is essentially one but functions in many ways and forms, it could be described as one or many.[44] The notions of polytheism and monotheism or of henotheism are appropriate only to a situation where god is a jealous, or limited individual being. These notions do not apply to the Indian conception of *deva*. Such is the notion of Devatā implicit in the Vedas and to be found explicitly in the Nirukta as well as the Upaniṣads[45] and later tradition.[46]

Myths in the Vedas are narratives (*ākhyāna*) of the birth and deeds of gods. These *ākhyānas* are symbolic in nature. When Indra destroys Vṛtra and frees the cows from captivity, we have a celebration of the victory of light over darkness, of fertility over sterility. The laws of the gods, their *ṛta, vratas, dharmas* are the paradigms of right human conduct. The details of sacrificial ritual were themselves intended to illustrate the law of Ṛta. To

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understand the Veda we must turn to the Veda itself in the first instance but we must do so without prejudice or preconceptions, whether born of modern ethnology or of ancient Mīmāṁsā ritualism. Of documents useful for comparison, the *Avesta* holds the highest place. The study of the *Vedāṅgas-Śikṣā* or phonetics, *Vyākaraṇa* or grammar, *Chandas* or metrics, *Nirukta* or etymology, *Kalpa* or ritual, and *Jyotiṣa* or astronomy—has always been regarded as a necessary ancillary study of the Veda. Again, the knowledge of ancient history and tradition, including myths and legends, has been regarded as indispensable to the right understanding of the Veda—'*Itihāsa-purāṇābhyām vedam samupabṛṁhayet.*' The hermeneutic principles of the Mīmāṁsā must be regarded as similarly indispensable. However, the interpretation of the Veda also depends on the hypothesis one adopts about its authors and their location in historical time and social context. In modern Vedic interpretation, the principal hypothesis in this regard has been drawn from Indo-European philology. It now faces the challenge of changed scientific notions about race as well as the challenge of new archaeological discoveries.

One of the most pervasive assumptions of modern Vedic scholarship has been that it is the Aryan invaders of India who composed the Vedas some time about 1200 BC. When the Indus Valley Civilization was first discovered, it was quickly assumed that it was pre-Vedic and non-Aryan. Some Indian historians have embellished this by regarding the invading Aryans as nomadic pastoralists. The social content of the Vedas has been analysed on these assumptions.

In 1786, William Jones had propounded the view that the similarities between languages like Greek, Latin, Persian and Sanskrit are too great to be the result of accident. The similarities betoken a genetic relationship between them. As Jones stated about these languages, '...no philosopher could examine them all without believing them to have sprung from some common source, which perhaps no longer exists.'[47] This has led to the theory that there was an original Indo-European language from which most of the languages of Europe, Iran and northern India are descended. This language and its speakers were called Aryan and, by a comparative analysis of the different historical languages derived from it, an attempt was made to reconstruct the original language and the process by which the former were derived from it. An attempt was also made to determine the original habitat and culture of the Aryans by what may be described as linguistic palaeontology. Ancient cognate words between Aryan languages were analysed to give information about the things and ideas with which the Aryans were familiar. However, no agreement could be reached about the original habitat of the Aryans. They were placed by some in Europe, by others in Central Asia and by still others in south Russia. The reconstruction of their migrations has remained equally uncertain. Since the Aryans are defined linguistically and not by their material culture, it is difficult to identify protohistoric archaeological sites as Aryan. Assuming that the Aryans were originally a Chalcolithic community practising both farming and the domestication of animals, familiar with the horse, birch, mountains and the sea or large lakes, their habitat could be anywhere from north-western India and central Asia, to south Russia and Central Europe.[48] When and how Aryan migration began remains indeterminate. Their firm historical presence may be ascertained from some of the Boaghaz-koi records. From the manner in which Aryan gods have been mentioned in the famous treaty of Mattivaja and Shubbililiuma it seems that they are Vedic Indian gods, not Indo-European or Indo-Iranian. On the other hand, those who date the migration of the Aryans into India in the second half of the second millennium BC, interpret these gods as Indo-Iranian and suggest that the Aryans were moving towards Iran and India about the middle of the millennium.[49]

At this point it is necessary to reflect on the uncertainties in which the Aryan theory is at present involved.[50] In the first place one can hardly reconstruct an unknown language by any known rules of linguistic change. For example, a philologist who knows Hindi, Bengali,

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Marathi etc. but no Sanskrit, cannot reconstruct Sanskrit by any comparative study of these modern languages. Similarly, the study for example of Greek, Avestan and Vedic records so widely different in space and time, can hardly suffice to reconstruct Ur-Aryan. Since the historical records of the successor languages coming from different dialects with some family resemblances belong to disparate times and places, it is difficult to be certain of the original vocabulary lying buried in them and its original meaning or meanings. Were the Aryans familiar with the beech or the elm? Did they know the sea? What was the grain they grew? When did they come to know copper and bronze or cotton? Such questions cannot be answered with any certainty. It would be more realistic to think of 'Aryans' as consisting of many different communities spread far and wide, speaking different dialects with certain family resemblance, and moving in different directions at different times. There is no reason to postulate any ethnic kinship or similarity of environment for these communities.

As a result it would be futile to seek to understand the Vedas in the light of a hypothetical Aryan race, culture or history. Such a procedure would tend to obscure the meaning of the Veda by the hypothetical constructs of comparative Aryan philology, comparative mythology and comparative religion. On the other hand, the Vedas undoubtedly constitute the earliest Indian literary records. If they are Aryan, the Aryans should be understood through them. It is true that the struggle of Aryans and non-Aryans has been read in the Veda and some have gone so far as to say that it is the Aryan hosts led by Indra which destroyed the non-Aryan Harappan civilization.[51] Earlier the same hypothesis of Aryan *vs.* non-Aryan conflict was interpreted as the struggle of civilized Aryans against black and snub-nosed primitive aborigines. It is obvious from these contradictory identifications of the Dāsas and Dasyus that the identifications are not really based on objective evidence.[52] The fact is that the word 'Ārya' has never been understood in the Indian tradition in any ethnic sense. Its meaning has consistently been 'noble', 'cultured'.

At the same time, *dāsa* and *dasyu* in the Veda appear to have the meaning of demons, the natural enemies of the gods. The struggle of the gods with the *dāsas* is the struggle of the forces of light with those of darkness. The noble-minded and cultured peoples, the *āryas*, are the worshippers of the gods who befriend them in the struggle against unrighteousness. What the Vedas record is a perennial struggle in the human heart, not a historical struggle among specific ethnic communities.

There have been many attempts to date the Veda on the basis of relative literary chronology. Thus Max Müller was led to date the *Ṛgveda* to about 1200 BC, allowing two hundred years each to the *Brāhmaṇas*, the later *Saṁhitās* and earlier *saṁhitā* or *chandas* prior to the *sūtras* which he dated between 600 BC, and 200 BC. The similarity of the Vedic to Avestan language has been adduced as further confirmation of this chronology. Unfortunately, the date of Zarathustra is itself quite uncertain [53] and the uniform temporal measures proposed by Max Müller are wholly speculative. On the other hand, astronomical evidence has been adduced by a number of scholars to suggest that the *Ṛgveda* may be dated between 6000 and 4000 BC. The date of the *Śatapatha Brāhmaṇa* should be about the middle of the third millennium BC. The date of the *Vedāṅga Jyotiṣa* would be about 1400 BC.[54] These dates have been rejected on the ground that the Vedic authors could not be expected to record reliable astronomical data. Besides the meaning and interpretation of the Vedic texts have also been questioned. The first of these arguments is quite untenable because mankind in the earlier days, going as far back as the Neolithic age is known to have made careful observations of celestial phenomena to keep time for ritual purposes.[55] The second of the two objections may be refuted in detail.

The crucial factor in dating Vedic literature today is the relationship of the Vedic and the Harappan. Beginning with Marshall to Piggott and Wheeler, most archaeologists till yesterday have been firmly of the opinion that the Harappans were non-Aryan and non-Vedic,

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preferably Dravidians. Recently, however, some archaeologists have begun to question the long-established hypothesis.[56] The reasons for regarding the Harappans non-Aryan and non-Vedic have been various. The horse was dear to the Aryans, it was apparently unknown to the Harappans. Aryan Vedic civilization was nomadic-pastoral or at best rural, while the Harappans built the first urban civilization in India. Vedic religion worshipped gods in an aniconic manner and had no temples or images. The Harappans apparently had temples of some kind as also images. The Harappans had female deities and also worshipped symbols of fertility. Rudra Paśupati could have been a Harappan god. He is clearly an apotropaic god in the Vedas which have no major female deities and condemned phallic worshippers. The Harappans were literate while the Vedas are a wholly oral tradition and writing disappears after the Harappans for a long time. Against these arguments it may be urged now that the evidence of the horse has now surfaced at several places in the Indus Civilization which must also have had rural and sylvan aspects. It is these aspects which might be reflected in the Vedas. Besides, the Vedas do speak of many *pur's* which could refer to towns or fortified places. Evidence of sacrificial worship has also surfaced in the Indus civilization and we know too little about the meanings of images and symbols from the Indus Civilization to dogmatize about their religion. As for writing, it is not certain that the Vedic society was preliterate, nor is the extent of the use of writing in the Indus civilization determinable.[57]

On the other hand, the geographical area of the Vedic civilization as well as its knowledge of metals and economic activities correspond to those of the Indus civilization. The famous *Nadīsūkta* lists the rivers in an apparently east to west order. Beginning with the Gaṅgā and the Yamunā, the list goes on to mention the Sarasvatī, Śutudrī, Paruṣṇī, Asiknī, Marudvṛdhā, Vitastā, Ārjikīya, Susāmā, Tṛṣṭamā, Rasā, Śvetyā, Sindhu, Kubhā, Gomatī, Krumu, and Mehatnu. Thus we have here, after the Gaṅgā, Yamunā, Sarasvatī, in order, the rivers of the Punjab and then of Afghanistan. In the distance lay the Mūjavant mountains and the land of Bālhika or Balkh, on the other side the edge of the desert (*dhanvan*). The rivers go to the sea which is quite important in the *Ṛgveda*. The geographical horizon of the early Vedic age is thus much the same as that of the Indus Civilization which has been sought to be named now as the Indus Sarasvatī or the Sarasvatī-Civilization.

Similarly, the knowledge of copper and bronze tools, but not of iron, and of farming as well as pastoralism, of villages as well as towns, suggests a cultural landscape which is comparable to the Indus-Sarasvatī civilization. Pre-iron Chalcolithic technology, indeed, acts as a chronological marker and tends to locate the early Vedic age in the bracket, 3500 BC, to 1200 BC. This would be in agreement with astronomical data also. Since the Vedic and the Indus civilizations, thus, appear to overlap chronologically and geographically, they could be identical or variations of a single civilization in terms of cultural directions, geographical concentration or chronological phases. The Vedic seers are aware of towns but prefer the quiet life of forests. They know of traders but are critical of them.[58] They concentrate on moral and spiritual, not material values. But they are not hostile to material prosperity and happiness. They believe in an undivided human good to be gained from the favour of the gods. Their sense of conflict and struggle is moral, not material or ethnic. As a matter of fact, even the Indus civilization, despite its fortified towns, gives little evidence of any active warfare. Perhaps the city walls were intended not against enemy forces but against floods or animals or unauthorized intruders.

It may be seen from the preceding discussion that the authors of the Vedas can only be described as ancient Indian seers without any specific ethnic identification. The hypothesis of an 'Aryan invasion' of India deriving from philological and race-theorist assumptions, has not been confirmed by historical or archaeological evidence. The racial composition of the Punjab has been proved to have been mixed and virtually constant from Harappan times.[59] There is a reason to suppose that the Sanskrit language was no intruder in India. The

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interaction of Sanskrit with Dravidian and Austric languages is historically attested but there is no definite evidence that Dravidian was spoken in *uttarāpatha* in Vedic times.[60] How far back does Brāhmī go in time is unknown. Nor is the origin and antiquity of Brāhmī and its relationship to the Harappan known with any definitiveness; while the Harappans are known to have been ethnically mixed, their language is unknown. Hence, although the Harappans and the Vedic people were not too far removed in time and place their exact relationship cannot be determined. Since the deities in the Boghazkoi inscriptions referred to before may be identified with Vedic deities, the origin of the Vedas could be placed some time before the middle of the second millennium BC. Astronomical evidence suggests that it should go back to the third or even earlier.

The Vedas, thus, are not the historical documents of an invading race recording ethnic conflict and primitive fancies but the earliest expression of the Indic tradition. On the one hand, it is focused on cosmology, of which theology is a part; on the other, it relates to philosophical anthropology which includes social ethics at its centre. The two sides were joined together by the science and practical symbolism of ritual. Cosmology was conceived as a meditative science which had for its object the regulative principles manifesting cosmic phenomena and called *devas*. These are again ultimately unified in one primal being which is the intelligent cause of the universe. Since this intelligent cause was named Brahman, the cosmology came to be called Brahmavidyā in later times and the earlier vogue of meditative comprehension called *Vidyā, Upāsanā or antaryāga* was replaced by pure inquiry. Although Brahman was cosmologically conceived originally, Upaniṣadic enquiry concluded that it is the eternal and infinite Absolute where knowledge and being meet and which is the ground of all finite appearances. This position, in effect, moved beyond cosmology and culminated in Brahmādvaita.

The gap between social ethics and cosmology was earlier bridged by ritual which reflected *Ṛta* or cosmic law willed by the gods. Social ethics was then a system of ritual sanctification for all important departments of social life-birth and death, education and marriage, livelihood and retirement, governance and war. Appropriate rituals for each occasion reminded one of the right way and ideals, of the need for right resolve and seeking the favour of the gods. This ritualism is, in its essence, neither magical not mechanical. It is the reinforcing of moral resolve by the aid of symbolism which, being habitual, hallowed and socially approved, functions as a psychically integrative cue.[61]

NOTES AND REFERENCES

1. Vide Moti Lal Sastri's *Vedasya Sarvavidyānidhānatvam*, Manavasrama, Jaipur.
2. Commentary ad. *Brahmasūtras*, I.I.3.
3. *Mahābhāṣya*, Vol. I. p. 64 (Delhi 1979), cf. *Vedic Age*, p. 230; B.B. Chamtre (ed.), *Saṁskṛtā Vāṅmaya kā Bṛhad Itihāsa*, Vol. I, pp. 73ff.
4. Traditionally Veda is regarded as constituted by both *mantra saṁhitā* and *Brāhmaṇa*, which follows the Āpastambīya dictum '*mantra-brāhmaṇayor vedanāmadheyam*' but there was another tradition which regarded the Veda as primarily the *mantra saṁhitā*. Dayananda revived this tradition—vide Yudhishthira Mimamsaka, *Vaidika-siddhānta-mīmāṁsā*, Vol. I, pp. 139-56.
5. Cf. Prof. K. Chattopadhyaya, *Studies in Vedic and Indo-Iranian Religion and Literature*, Vol. I. pp. 17ff. The following scheme seems to have been followed by the original redactors:

   (a) the family groups were 'arranged according to the decreasing number of the hymns in each of these books'.

   (b) within each family group, the Agni hymns came first, then the Indra hymns and then the Viśvedeva hymns (if there were any) and after them hymns to the other deities in due order; and

   (c) within each *devatā* sub-group, the hymns were arranged according to the diminishing number of stanzas contained in them. But this general scheme has exceptions.

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6. For example, *Kātyāyanīya sarvānukramaṇī* (1985), pp. 1-3. The Paribhāṣā section describes these—'*Yasya vākyaṁ sa ṛṣiḥ*' (2,4). The *vṛtti* of Sadguruśiṣya quotes from *Nirukta* (2,11) '*Ṛṣir darśanād*'. The Ṛṣi, thus, is the seer and the speaker of the *mantra*. The object which is communicated by the *mantra* is *devatā*—*Yā tenocyate sā devatā* (2.5), *Chandas* is the measure of the syllables '*Yadakṣara-parimāṇam tacchandaḥ*' (2.6).
7. Cf. Macdonell (ed. & Tr.) *Bṛhaddevatā*, 2 vols. (1965), Vol. I, p.1

   '*Stutis tu nāmnā rūpeṇa Karmaṇā bāndhavena ca /*
   Svargāyurdhana-putrādyair arthair āśīṣ tu kathyate//' (7)

   But *ṛks* devoted to both praise or petition are few and fewer are those which seek heaven—(8). However, praise and petition are basically the same (10)

   Mantrā nānāprakārāḥ syur dṛṣṭā ye mantradarśibhiḥ/
   Stutyā caiva vibhūtyā ca prabhāvād devatātmanaḥ//

   The next five verses describe these diverse types of hymns—'Praise, laudation, blame, doubt, plaint, desire, prayer, boasting, request, question, summons, enigma, commission, injunction, vaunt, lament, narration, conversation, purifying narrative, lascivious verses, obeisance, obstacle, resolve, prattle, reply, prohibition and admonition, intoxication and denial, invitation, agitation, wonder, abuse, eulogy, invective, curse'.

   The *Nirukta* (7,3) illustrates hymns of *śruti, āśīs, ācikhyāsā, paridevana, nindā, praśaṁsā*.
8. For the structure of ritual and the role of different kinds of priests in it, see Sāyaṇa's commentary I, pp. 1-2 Cf. Winternitz, *History of Indian Literature* (Eng. tr.), Vol. I, pp. 161-2.
9. Cf. Winternitz, op. cit., p.171; on the contrary. B.K. Ghosh in *Vedic Age*, p. 235.
10. *Mīmāṁsā-sūtras*, 1.2.1.
11. Instead of saying that a verse may be sung to a certain tune or melody, the Vedic usage declares the verse (*ṛc*) to be the source or *yoni* of the melody. The Ārcika 'may be compared to a songbook, in which only the text of the first stanza of each song is given as an aid to the recollection of the tune, (Winternitz, op. cit., Vol. I. p.165).
12. Ib. l.c; vide G.H. Tarlekar, *Saman Chants in Theory and Present Practice* (1995).
13. On *Agnicayana*, see Vishvambhara Nath Tripathi, *Agnicayana*, Varanasi, 1990.
14. See below, Chapter on Vedic Technology, Cf. B.P. Roy, *Later Vedic Economy*.
15. Vide *Sarvadarśanasaṁgraha* on the Mīmāṁsā doctrines, Sāyaṇa, op. cit., I. pp. II ff.
16. Cf. My essay in *Culture and Modernity* (pub. Hawaii University).
17. Mahābhāṣya = '*Rakṣohāgamalaghvasandehāḥ prayojanam.*'
18. *Mīmāṁsasūtras*, '*Āmnayasya Kriyārthatvād ānarthakyam atadarthānām*' (1.2.1) Thus begins the *Pūrvapakṣa* which goes on till 1.2.18. see Sāyaṇa, op. cit., p. 7.
19. Preface to the *Ṛgveda saṁhitā*, Vol. III.
20. K. Brugmann, (Eng. tr. by Wright), *Comparative Grammar of the Indo-Germanic Languages*, 5 vols. (Chowkhamba, 1972); Wackernagel, *Altindisches Grammatik;* Macdonell, *Vedic Grammar;* Bohtlingk and Roth, *Sanskrit Worterbuch*, 6 Vols., (Motilal); Grassmann, *Worterbuch des Ṛgveda;* M. Mayrhofer, *A Concise Etymological Dictionary of Sanskrit;* Max Müller, *Vedic Hymns*, 2 Vols. (SBE); H. Oldenberg, *Die Religion des Veda;* Ludwig, *Der Ṛgveda*, 6 Vols.; Oldenberg, *Ṛgveda, Text Kritischen und exegetischen Noten* 2 vols.; Gonda, *History of Indian Literature*, Vol. I; Winternitz, (Eng. Tr.), *History of Indian Literature*, Vol. I; Whitney, *Atharvavedasaṁhitā*, 2 vols.; Bloomfield, *The Religion of the Veda;* Geldner, *Der Ṛgveda* (HOS); Macdonell, *Vedic Mythology*, Macdonell and Keith, *Vedic Index*, 2 vols.; Keith, *Religion and Philosophy of the Vedas and the Upaniṣads*, 2 vols.; Bergaigne, *La Religion Vediques* (Eng. Tr. Paranjape), Renou, *Bibliographic Vedique;* Dandekar, *Vedic Bibliography;* Hillebrandt, *Ritual Litteratur*.
21. 'The ritual system recognized by Sāyaṇa may in its externalities stand; the naturalistic sense discovered by European scholarship may in its general conceptions, be accepted; but behind them there is always the true and still hidden secret of the Veda, the secret word, *ninya vacamsi*, which were spoken for the purified in soul and the awakened in knowledge.' (Aurobindo, *The Secret of the Veda*, Pondichery, 1987. p. 6).
22. Coomarswamy, *A New Approach to the Vedas*, (1933).

    'What I have called here a new approach to the Vedas' is nothing more than an essay in the exposition of Vedic ideas by means of a translation and a commentary in which the resources of other forms of the universal tradition are taken for granted' (p. viii)

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23. *Vedic Hermeneutics*, p. 12;
On Vedic interpretation see my *Foundations of Indian Culture*, Vol. I., pp. 11-20; K.S. Murty, *Vedic Hermeneutics*, pp. 9-13; Max Müller, *Vedic Hymns*, Vol. I Prefaces; Winternitz, *History of Indian Literature*, Vol. I, pp. 69-75 indicates the state of Vedic interpretation in the west; Cf. K. Chattopadhyay, *Studies*, II, pp. 54-6.
24. Yāska in *Nirukta* (1.5.15-16) notes and refutes the opinion of Kautsa to the effect that the Vedas have no meaning. In the Veda the word order cannot be changed nor synonymns used to replace the words, hence the Vedic words cannot be like the ordinary words which have meaning. Nor can their meaning come from the practical context of ritual since this comes to be known from the *Brāhmaṇas*. The hymns contain contradictions—there is only one Rudra, there are countless Rudras, Indra has no enemies, Indra conquers a hundred hosts. The hymns contain implausible meanings—'O herb, protect him', 'O axe, do not injure'. Injunctive words to their priests are meaningless since they already know their business. Then, again, the hymns contain unconnected meanings—Aditi is the sky, it is the atmosphere, it is everything. Again, some Vedic words have no clear or definite meaning, e.g., *Kanuka*.

These doubts in Vedic interpretation, it would be noted, have continued down the ages. Yāska replies that the Vedic language is similar to the language of ordinary usage, that the *Brāhmaṇas* depend on the hymns, that questions of plausibility need to take the tradition (*amnaya*) into account, that apparent contradictions occur in normal speech too, that for clearly seeing the meanings of the Veda one must have insight—'*Naisa sthāṇor aparādho yadenam andho na paśyati purusāparādhah sa bhavati*'.

In *Nirukta* (2.16) Yāska says, '*Ko vṛtro megha iti nairuktāḥ tvāṣṭro'sura ityaitihāsikāḥ*'.
25. *Nirukta* 1,19. '*Artham vācaḥ puṣpaphalam āha Yājñadaivate Puṣpaphale devatādhyātme vā*,' Durga says, '*Yajñaparijñānam yājñam devatāparijñānam daivatam ātmani adhi yad vartate tad adhyātmam*'. From the sacrificial meaning one is led to the knowledge of *devata* and that culminates in knowledge of the Self. Thus *devopasana* leads to *Atmopasana*.

Yāska points out diverse meanings—e.g. 3.12,11.42,12.37. Cf. Yudhiṣṭhira Mīmāṁsaka, op. cit., I, pp. 38ff. Bhartṛhari in *Mahābhaṣyadīpikā--Yathā idam viṣṇur vicakrame ityatra eka eva viṣṇuśabdo'nekasaktih san adhidaivatam adhyātman adhiyajñam cātmani nārāyane caṣāle ca tayā śaktyā pravartate*'. (Quoted in Yudhiṣṭhira Mīmāṁsaka, op. cit., p. 107);

'*Yaḥ Kaścid ādhyātmika ādhidaivika ādhibhautiko vārtha ākhyāyate sa itihāsa ityucyate*' (Durga ad N..10.26);

Cf. Tai, Upa (1.3.'1).

'*Athātaḥ saṁhitāyā upaniṣadaṁvyākhyasyāmaḥ. Pañcasvadhikaraṇeṣu adhilokam adhijyautisam adhivedyam adhiprajam adhyātamam*'

Durga on *Nirukta* (4.19) distinguishes *adhyātma, adhidaiva, adhibhūta* and *adhiyajña*

So *Śāṅkhyāyana Gṛhya* (1.2.18.19)

=*Adhidaivam athādhyātmam adhiyajñamiti trayam/*

Mantreṣu Brāhmaneṣu caiva śrutam ityabhidhīyate//

see Yudhiṣṭhira Mīmāṁsaka, *Vaidika-siddhanta-mimansa*, Vol. I, pp. 74 ff.
26. Cf. Yudhiṣṭhira Mīmāṁsaka op. cit., I, pp. 38ff; also Dyananda's commentary on *Ṛgveda*.
27. Vide my *Bhaktidarśanavimarśaḥ*.
28. See below
29. Vide my *Bhaktidarśanavimarśaḥ;* Susmita Pande's *Birth of Bhakti in Indian Religions and Art*, Cf. *Bhakti and the Handmill*, which attacks such accounts as being tainted by 'essentialist' historiography. The criticism flies in the face of evidence.
30. Cf. my *Life and Thought of Śankarācārya*.
31. Kapali Sastri, op. cit.
32. Coomarswamy, op. cit.,
33. Vide his *Ṛgvedādibhāṣya bhūmikā*.
34. For example, his *Veda Kā svarūpa vicāra* (Jaipur), or his many-volumed Commentary on the *Śatapatha Brāhmaṇa*.
35. Tylor, *Anthropology* (Thinkers Library), Vol I.
36. R.R. Marett, *The Threshold of Religion* (1914).

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37. Cf, my *Studies in the Origins of Buddhism;* Keith, *Religion and Philosophy of the Veda,* Vol. I.
38. Cf. *Nirukta* 75—'*Tisra eva devatā iti Nairuktā Agnih Prthivsthāno Vāyur vendro vāntarikṣasthānaḥ sūrya dyusthānaḥ*'.
39. Vide Macdonell, *Vedic Mythology;* Keith op. cit.,Vol. I, Part II.
40. Vide my *Studies in the Origins of Buddhism,* pp. 265-72.
41. Sāyaṇa, op.cit, I, p. 24—'*Devo dānādvā dīpanādvā dyotonād vā dyusthāno bhavatīti vā*'.
42. R. Lipsey (ed.), *Selected Papers of Coomarswamy;* V.N. Tripathi, *Agnicayana,* pp. 220-7.
43. Cf. *Nirukta* 7.6-7—'*Puruṣavidhāḥ syuritekam cetanāvaddhi stutayo bhavanti....apuruṣavidhāh syurityaparamapi tu yad dṛsyate ubhayavidhāḥ syurapi vā puruṣavidhānāmeva satām Karmātmāna etc syuryathā yajño Yajamānasya eṣa Cākhyānasamayaḥ*'.
44. Ibid 104—'*Māhābhāgyād devatāyā eka ātmā bahudhā stūyata ekasyātmano'nye devāḥ pratyaṅgānibhavanti... itaretara-janmāno bhavanti itaretaraprakṛtayah karmajanmāna ātmaiveṣām ratho bhavatyātmāsya ātmāyudham ātmeṣava ātmā sarvaṁ devasya*'.
45. E.g., *Ṛg* 1.164.
46. On the modern understanding of the nature of the Vedic gods, see my *Studies in the Origins of Buddhism* (4th ed.), pp. 265ff; Keith, *Religion and Philosophy of the Vedas and Upaniṣads,* Vol. I, pp. 55ff, Macdonell, *Vedic Mythology;* Oldenberg, *Religion des Veda;* K. Chattopadhyaya, *Vedic Religion.*

    On the traditional understanding of the *devatā* see Yāska, *Nirukta, Daivata Kāṇḍa, Vedāntasūtras* 1.3, 26-33 and Śaṅkara's commentary on it, *Yoga-sūtras,* I-28; Ibid II, 44.
47. *Cambridge History of India,* Vol. I, 64.
48. Giles supposes the Indo-Europeans knew the beach and argues—'There is apparently only one such area in Europe, the area which is bounded on its eastern side by the Carpathians, on its south by the Balkans, on its western side by the Austrian Alps and the Bohmer wald, and on the north by the Erzgebirge and the mountains which link them up with the Carpathians *Cambridge History of India,* Vol. I, p. 68).

    '*Sākṣātkṛtadharmāṇo rsayo babhūvuh. Te'varebhyo ṣakṣātkṛtadharmabhya Upadeśena mantrān prāduḥ.*' (Nirukta 1.20).

    '*Ṛṣer dṛṣtārthasya prītir bhavatyākhyānasaṁyuktā.*' *Nirukta* 10.10

    Itihāsapurāṇābhyām Vedam samupabṛṇhayet' (Mahābhārata 1.1.36)
49. On one identification of the gods in the Boghaozkoi inscriptions, see B.K.Ghosh. *Vedic Age,* pp. 208-9; against it, K.Chattopadhyaya *Studies,* I, pp. 121-31.
50. On the 'Aryans' philologically, see Giles in *Cambridge History of India,* Vol. I, and *Encyclopaedia Brittanica,* 11th ed. II, XIV; B.K. Ghosh, *Vedic Age, The Aryan Problem* and *Survey of Indo-European Languages;* and S.S.Misra. *The Aryan Problem* (1992); Ram Vilas Sharma. *Bhārata Ke Prācīna Bhāṣā Parivāra Aur Hindi,* 3 vols. For the older works on the Aryans generally, see Otto Schrader (Eng.Tr.) *Prehistoric Antiquities of the Aryan Peoples* (1890); Gordon Childe. *The Aryans* (1926); Asimov (ed.), *Ethnic Problems of the History of Central Asia in the Early Period* (1981); Renfrew, *Archaeology and Language,* (1987).
51. On Vedic and Harappan, see K. Chattopadhayay, op. cit., II. pp. 41-53, as an example of an Indian Vedic scholar's objections to their identification; similarly from the archaeological side the difference argued by Marshall finds full expression in Wheeler, *Indus Civilization*

    But the archaeologists are beginning to change, see F.R. Allchin in Possehl (ed.), *Harappan Civilizaiton* (2nd ed.) p. 392—'In the north of the region there was an appearance of Indo-Aryan speking people even during the life of the civilization.'

    For the identification of Vedic and Harappan, see Bhagwan Singh's substantial work, *The Vedic Harappans,* 1995.
52. On Dāsa and Dasyu as demons, see K. Chattopadhyaya, 'Dāsa and Dasyu in the Ṛgveda', (*Proceedings of the Nineteenth International Congress of Orientalists* held at Rome.)
53. Vide K. Chattopadhyay, op. cit., II, pp. 127-58.
54. On the astronomical evidence for dating the Vedas, Tilak, *Orion;* David Frawley's *Gods, Sages and Kings,* Part III, gives an excellent survey; Cf. Subhash Kak. *The astronomical Code of the Ṛgveda* (1994); On the relative chronology of the *Ṛgvedasaṁhitā* and the arrangement of hymns within it, see K. Chattopadhyaya, *Studies in Vedic and Indo-Iranian Religion and Literature,* Vol. II, pp. 16-24.
55. On the date of *Vedāṅga Jyotiṣa* see below—Dr S.N. Jha's chapter; for astronomical observation before civilization; E.C.Krupp, *In Search of Ancient Astronomies* (Penguin, 1983).
56. See above, note 48.

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57. Cf. K. Chattopadhyaya op.cit., II, pp. 63-71.
58. See my *Foundations of Indian Culture,* II.
59. D. Sen in *Ancient India,* 1964-65.
60. According to Grierson's *Linguistic Survey of India,* the Indo-Aryan languages are divided in three outspreading bands. In the Centre are the Midland languages of which Western Hindi is the chief. This area corresponds to the Brahmarṣideśa of Manu. Outside this is the Inner Band Punjabi, Rajasthani and Gujrati on the West, Pahari on the north, and Eastern Hindi on the east. Beyond these is the outer Band of Kashimiri, Lahnda, Sindhi, and Kachi on the West. Marathi on the southwest, Bihari, Bengali, Assamese and Oriya on the east. This expansion corresponds to the emergence of Āryāvarta out of Brahmarṣideśa.

    But this does not square with the hypothesis of Aryan invasion from the northwest, in which case the Saptasindhu should have been the Central area. Grierson, following Hoernle has suggested the hypothesis of two Aryan invasions to explain the contrast between the Indo-Aryan Languages of the outer Band from those of the Central and Inner Band. This has been disputed by S.K. Chatterjee and others but supported by some archaeologists now—see Ram Vilas Sharma, *Bharat Ke Prachin Bhastha Parivar Aur Hindi,* Vol I, p. 277ff: Bridget and Raymond Allchin, *The Rise of Civilization of India and Pakistan* (1983), p. 301.

    Cf. 'The diversity of speech in the Indian Empire, like the diversity of race, is naturally explained as the result of invasions from Western and Further Asia' *Cambridge History of India,* p. 52. Why could not the ethnic diversity of India be native to it. 'When an Aryan tongue comes into contact with an uncivilized aboriginal one, it is invariably the latter which goes to the wall.' The aborigines adopt a '"pigeon" form of the languages of a superior Civilisation' and in time the old aboriginal language is forgotten and dies a natural-death, *Cambridge History of India,* Vol. I, p. 50, quoting Grierson.

    It is assumed that Sanskrit adopted the cerebral from the Dravidians who must have been the principal pre-Aryan aborigines of India.

    This assumes that the Aryans had a superior civilization and it is not of the Harappans. But if they were Dravidian, why has Dravidian disappeared from north-western India.
61. See my *Aspects of Jaina Political Thought.*

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CHAPTER XX

Vedic Society

Sibesh Bhattacharya

In current historiographical discourse, Vedic society is taken to signify a particular stage in the socio-economic evolution of the Indian people, but the nature of the evidence that we have to rely on militates against the possibility of reconstructing an actual historical phase of socio-economic evolution with any appreciable measure of fullness and precision. Vedic literature was avowedly religious and ritualistic; it was the product of a small group with a specific purpose. To construe it as a historical document mirroring a whole society is not in consonance with the tenets of historical methodology. It is true that there is a discernible trend of growth in Vedic literature; from the *Ṛgveda* onwards it continuously amplifies both in scope and volume. This process of amplification has often been viewed, and not totally without justification either, as the process of historical growth of early Indian society. It, however, is crucial to remember that a trend-indicator should not be taken as a representation of a fully detailed picture. Arguments based on negative evidence, especially in regard to the *Ṛgveda*, to draw implications about the character of society tend to forget that the *Ṛgveda* is a book of hymns collected by a few priestly families and that its universe therefore is likely to be a limited one. The character of that universe must have been defined by the concerns of the poet-priests of the text. This must have been more or less true of the whole of Vedic literature.

Moreover, different patterns of living and lifestyles coexisted in the country. The mode of living in a hermitage, for example, was closer to pastoral than to agrarian life and a text growing in a *tapovana* would reflect the moorings of a hermitage more than those of the agrarian villages or of urban centres. To universalize the societal horizons of a class of literature as the only one obtaining at the time does not appear to be a fair treatment. Archaeology is likely to provide a sounder base for tracing the actual process of socio-economic evolution, but till the vexed question of correspondence between the archaeological and Vedic evidences has been satisfactorily settled, archaeology is of not much help for the reconstruction of 'Vedic society'. We have therefore avoided references to archaeological evidence in our sketch.

Our endeavour, therefore, mainly has been to underline how society was perceived by the authors of Vedic literature. This perception does not show any marked change during the span of Vedic literature. In our reconstruction of society depicted in Vedic literature, therefore, Vedic literature has been taken as a single unit and no attempt has been made at periodization within it. The Vedic notion of society hinged on the concept of man and his place in the cosmos as held by the authors of Vedic literature. In dealing with society thus we begin with the birth of the child and proceed as the child grows and encounters the larger world.

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'Propitious hath this woman come to the home; Dhātar appointed this world to her; O' Aryaman, Bhaga, both Aśvins, Prajāpati let her increase with progeny.'[1] This prayer, a part of the marriage ceremony, seeking the welfare and fulfilment of the bride, typifies the Vedic outlook on family and family life. The begetting and rearing of children were looked upon as the primary function of family. The desire for offspring, especially male children, was natural in a society where life was hard and demanding. Struggle, insecurity and death were accepted as parts of existence: 'Go hence, O Death... touch not our offspring, injure not our heroes ... May they survive a hundred lengthened autumns ...Let their unwidowed dames with noble husbands adorn themselves with fragrant balm and unguent.'[2] 'Lead us anew to happiness, O Agni, lead us beyond all danger and affliction. Be unto us a wide broad ample castle: bless, prosper on their way our sons and offspring. Far from us, Agni, put thou all diseases ...'[3] Noble offspring; and 'hero sons' were among the most ardently desired boons in the *Ṛgveda*.[4] A whole *sūkta* in the *Ṛgveda* was dedicated to the objective of obtaining offspring.[5]

In a man's life family (*kula*) held a central place. The house was also called by the name *dama*, the place where a man wields total control.[6] The house was his castle; but it was also his nest. Thus *dampati*, which originally meant 'the master of the house' soon came to signify both 'the master and the mistress of the house', the husband and the wife.[7] However, a household (*gṛha*) was much larger than the nest of a *dampati*, it usually covered an extended family with several members (*gṛhya*).[8] The family (*kula*) usually was a large one, consisting of father and mother, the head of the family and presumably a large number of 'kinsmen',[9] all living under one roof. The newly wed couple, it was prayed, should attain the fullness of time and play and sport with sons and grandsons and that the bride should bear sway over the parents of her husband as also over his brothers and sisters.[10] The picture of a family that emerges from these descriptions is clearly that of an extended one.

The ties of kinship were strong and wide. An extensive variety of blood relationship, each with a distinctively defined name is referred to in Vedic literature. *Tātāmaha* or *pitāmaha* (grandfather, father's father), *pratātāmaha* or *prapitāmaha* (great-grandfather, father's father's father) *bhrātṛvya* (cousin, father's brother's son), *māturbhrātra* or *mātula* (uncle, mother's brother), *devṛ* (brother-in-law, husband's younger brother), *nanāndṛ* (husband's sister), *pautra* (grandson, son's son), *napāt* (probably grandson, son's son), *naptṛ, naptrī* (grandchild, son's daughter), *pranapāt* (great grandson, son's son's son), *svasrīya* (nephew, sister's son), *śvasura* (father-in-law), *svaśrū* (mother-in-law), *jāmatṛ* (son-in-law), *snuṣā* (daughter-in-law), *śyāla* (brother-in-law, wife's brother), etc., are some of the kinship relations, besides father, mother, brother, sister, husband, wife, mentioned.[11] The care with which the exact nature of the relationship is indicated in these terms shows how close and significant these kinship networks were considered.[12]

A child was thus normally born into and grew up amidst an extended family which was the child's earliest social setting. The birth of a son was preferred to that of a daughter[13] and the birth was greeted with festivities and ceremonies. The *Bṛhadāraṇyaka Upaniṣad* describes the birth ceremony in some details.[14] 'When [the son] is born, he [father] builds up a fire, places him on his lap, mingles ghee and coagulated milk in a metal dish and makes on oblation ... saying: "in this son may I be increased ..." Then he gives him a name ... This becomes his secret name. Then he presents him to the mother and offers the breast ...'[15] It appears that it was a normal custom to give a child a secret (*guhya*) name of mystical significance as well as an ordinary name.[16] Although the rules are not clear and consistent, it can be safely presumed that the name-giving was already a ceremonial affair. The first fifteen days after birth were considered as the dangerous period,[17] toward the end of which, on the eighth day, the infant was washed.[18] The early stages of the growth of the child like teething and learning to speak

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have been mentioned.[19] In all these one can perhaps notice the beginnings of ceremonies which later grew into *saṁskāras.*

Emotionally a child must have felt closest to the mother (*mātṛ, nanā*), but it was the father (*pitṛ*) who symbolized security and identity, for the father was both the 'protector' as well as 'the begetter'.[20] The warm and intimate relationship between father and son is depicted in a number of *Ṛgvedic* verses. Gods are compared with a loving father who carries his son in his arms and puts him on his lap; the father to whom the son looks up for help and protection when in trouble.[21] Depiction of a similar mother-son relationship is not common. The reason may be that an overwhelming majority of *Ṛgvedic* verses are dedicated to male gods, the father figures. However, a Ṛgvedic poet compares Indra with a mother. 'O Indra thou art more to me than sire or niggard brother is. Thou and my mother, O good Lord, appear alike....'[22]

Homestead (*gṛha, dama, pastya, harmya,* etc.) included, besides the living apartments, also some surrounding areas. It was not merely an abode (*āvasatha*) but also the settlement (*niveśana*) of the family.[23] 'It held not only the family which might be of considerable size, but also the cattle and the sheep....'[24] It had its sacred retreat, the sanctum of the family, the *agniśalā,* the *havirdhāna,* etc., where the religious ceremonies were performed. A house contained several rooms. Ladies' rooms (*patnīnāṁ sadana = wives'* rooms) presumably lay in the inner part of the house. It may be surmized that the plan of the house during the Vedic age was not different from the traditional Indian houses of the subsequent periods—rooms were built along the sides of a central rectangular courtyard. Ordinary houses were built of bamboo, wooden poles, reeds, thatches, etc. A house was often called *chardi,* perhaps on account of its thatched roofing.[25] The houses of the powerful and wealthy were more important—there are references to thousand-pillared houses in the *Ṛgveda.*[26]

Larger territorial and social networks acted as conditioning factors in the lives of families (*kula*) and households (*gṛha*). *Grāma* (village) was the most intimate territorial unit beyond the family. The villages were usually open; sometimes a number of villages lay together in a cluster,[27] sometimes they were scattered apart and were connected by roads.[28] Some villages were larger than ordinary ones and were called *mahāgrāma.*[29] Evidences do not provide details for sketching the layouts of villages but it seems a safe conjecture that clusters of houses composing a village lay surrounded by the fields of grain (*urvarā, kṣetra*).[30] Beyond these lay the forests (*āraṇya*) which were usually contrasted with settlements (*grāma, vṛjana*) and ploughed land;[31] the forest that was away from the village, where hermits lived;[32] the forest that was the 'mother of all sylvan things' and where tilling was not done and yet was laden with 'stores of food'.[33] On the outskirts of villages lay the pasture lands (*vraja*) where cattle went for grazing.

It is not possible to determine the social composition of *grāma.* Opinions differ whether the *grāma* represented a single clan or a more diversified community.[34] Society reflected in Vedic literature was predominantly agrarian with strong vestiges of pastoralism.[35] Vedic people looked upon cattle as wealth; they were objects of reverence and desire. Prayers were offered for wealth and kine[36] and battles were fought for their possession.[37] The cowherd (*gopa, gopāla,* the protector of cattle) was the arche-type of a ruler, the protector of his herd, the people (*gopā janasya*).[38] Hence the king was also called 'the lord of cattle' (gopati).[39]

Although people in Vedic villages drew their livelihood mostly from agriculture and farming, a number of other trades were also plied. There were potters (*kulāla, kaulāla*), carpenters (*takṣan, taṣṭṛ*), bamboo workers (*bidalakārī*); metal workers like the smelter (*dhmātā, dhmāṭṛ*), the smith (*karmāra*), the worker in gold (*hiraṇyakāra*); the more specialized craftsmen like makers of chariots (*ṛathakāra*), makers of bows (*jyākāra*), rope makers (*rajjukāra*), seamstresses (*peśakārī*), the dyers (*rajayitṛ*), etc. Then there were people providing services like barbers (*nāpita, vaptṛ*), washerman (*malaga*), etc. Direct references to weavers are not very common in Vedic literature, but there is enough evidence relating to the craft of

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weaving, the thread, the spindle, the weaver's shuttle, etc. (*tantu, tarku, tasara*), to conclude that weavers must have formed an important occupational group. And of course there were priests of various categories (*ṛtvij, hotṛ, udgātṛ, purohita, śrotriya,* etc.) to minister to the religious and spiritual needs of the people. Buying and selling, shopkeeping and usury (*kraya, vāṇijya, kusīda,* etc.) were not unknown. Many of the Vedic villages were obviously situated on the banks of rivers—Vedic culture, to a large extent, seems to have been riverine—and there are quite frequent references to boats, boatmen, fishermen, (*kaivarta, kevarta, dāsa, dhīvan, dhaivara, navaja, puñjistha,* etc.).[40] The occupational profile of rural life during the Vedic period, in its variety and distribution, thus, appears not markedly different from that of the subsequent periods in Indian history.

Social transactions were closest within the kin group called the *jñati*, the blood relations on the father's side.[41] The *Śatapatha Brāhmaṇa* contrasts the 'kin groups' (*jñatibhyah*) from the 'friends and companions' (*sakhibhyah*).[42] In the early Vedic period *gotra* probably did not have the same sense and significance as it acquired by the time of the composition of the *Sūtras*. *Gotra*, however, seems to have shed its original meaning, 'cowstall' or 'herd', by the age of the *Upaniṣads*. In the *Chāndogya Upaniṣad, gotra* meant a clan or a kin group.[43] The transition in the meaning of the term must have occurred in the same way as the meaning of *gopati* changed from 'master of cattle' to 'ruler'.

Blood relations were also sometimes called *bandhu*[44] and perhaps included kin both on the sides of father and mother.[45] Intimacy in social dealings was not based on blood relationship alone, there was also an intimate circle besides blood relations comprising 'friends and companions' too (*sakhi*).[46] Emergent status and class distinctions were gathering momentum. Birth and occupation were becoming important factors in determining a person's position and role in the society. It was common to look for and expect special support from one's peers in birth and communion (*sajāta, samāna-gotra, samāna-jana, samāna-bandhu,* etc.). 'Looking for weal I looked around in spirit, for kinsmen (*sajāta*), Indra-Agni, or for brothers. No providence but yours alone is with me: so have I wrought for you this hymn for succour. For I have heard that ye give wealth more freely than a worthless son-in-law or spouse's brother.'[47] The evenness of the tenor of life in villages was getting disturbed by the emergent distinctions of status and power. Thus 'concord' and 'harmony' (*saṁjñana*) were highly cherished.[48]

As a boy stepped into his teens, in some cases probably somewhat earlier, he was introduced to formal education. Śvetaketu's education began when he was twelve.[49] The nature, content and mode of education depended on the *varṇa* and the social position of the child.[50] The boy was initiated (*upanayana*) to studentship (*brahmacarya*) by the teacher. He stayed in the house of his teacher (*ācārya-kula vāsin; antevāsin*), collected fuel, tended the sacrificial fire, begged alms, served his teacher, learnt his lessons and practised penance. A thorough drilling was given to the student in scholastic subjects as well as in leading a life of abstinence and rectitude.[51] Sometimes a father would take upon himself the responsibility of instructing his son.[52] Normally studentship lasted for twelve years. Śvetaketu returned to his father's house when he was twenty-four after spending twelve years with his teacher. However, some carried on their student-lives much longer; a few carried on till death.[53] Most of the *brahmacārins* were Brāhmaṇas, but Kṣatriya and Vaiśya children also joined the Brāhmaṇa boys in acquiring Vedic education. Some Kṣatriya kings even dazzled Brāhmaṇa scholars by their learning and wisdom.[54] Girls belonging to scholar families were also given education, and some, like Gārgi Vācaknavī, would grow to take the very best of scholars on at learned disputes.

About the training of warriors, princes, etc., we do not have direct evidence. On the basis of evidence from later literature, however, it can be conjectured that systematic training was imparted in the wielding of arms and in warfare to children of *Rājanayas/Kṣatriyas*.[55] Similarly,

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it may be surmized that children of peasants, craftsmen, workers, etc., got practical training in their family trades from their seniors through direct participation in work.

A major thrust of education, apart from the acquisition of skills for making a living, was directed towards the preservation and amplification of the dominant values of the society. These values embodied the endeavours to harmonize human lives with what was regarded as the fundamental nature of the universe. 'Man must act as the gods act and the gods act by fixed and eternal law called *ṛta*.'[56] *Ṛta* was the natural law, both cosmic and moral; and *satya* or truth was its conjunct. Obedience to *ṛta* and *satya* was the highest virtue. Dhatar, the Creator created first *ṛta* and *satya* in the process of the creation of the cosmos.[57] '*Satya* is the base that upholds the earth.'[58] 'The *Ṛgvedic* attitude to morality is heroic. It prized virtue in the original sense of manliness which corresponds to the notion of *vīra* or *nṛ, vṛṣa*. Life is conceived as a struggle between the forces of light and darkness ... is a constant and hard choice between right and wrong. Goodness consists in the right and strenuous exercise of the will. Hence good life is essentially a life of action and the good man must aspire to be a hero.'[59]

Social stratifications were gradually emerging stronger and sharper. The original Vedic notion of society, however, does not seem to have been based on a distinctly defined concept of status and rank arising from occupation and birth. These hallmarks of later-day Indian social arrangements and their embodiment, the *Varṇa-Jāti* system, appear to have been absent in the early Vedic society. The classical formulation of the four-fold *varṇa* system makes its appearance for the first time in the famous *puruṣa sūkta* of the Ṛgveda. The early Vedic notion of social divisions was based on defining the roles of three orders of the society—the priestly Brahma, the political-administrative Kṣatra and the folk Viś.[60] It is this three-fold division, rather than the later four-fold *varṇas*, that constituted the original Vedic idea of society. Thus early Vedic gods to a large extent seem to have been conceived as enshrining the ideal virtues and interests of these three orders, the Brahma, Kṣatra and Viś. 'It is well known that the majority of the single collections of which the first seven Maṇḍalas[61] (and to some extent those of the tenth) are made up, begins with hymns addressed to Agni, which as a rule, are followed by hymns addressed to Indra. These, again, are in many cases followed by hymns to Viśve Devāḥ (and Maruts). Now, in the later dogmatic literature we find the three Aryan castes, the Brahman, the Kṣatra, and the Viś, identified with Agni, Indra, and the Viśvedevāḥ (all the gods, or, as a special class, the All-Gods) respectively.'[62] These three orders in the early Vedic society did not greatly emphasize heredity and occupation.[63] According to a Vedic tradition it was a prince, Pṛthu Vainya, who invented the art of agriculture and the practice of leading a settled life.[64] Kings chose to give their daughters in marriage to Brāhmaṇa priests.[65] It appears that the means of livelihood was not yet a major factor in determining social divisions; it was rather the role and duty which one performed that distinguished one's social position.

However, *varṇa* distinctions arose in the closing stages of the *Ṛgvedic* period. In the Brāhmaṇa texts, these social distinctions are more marked and numerous and are distributed over the four traditional *varṇas* of Brāhmaṇa, Kṣatriya, Vaiśya and Śūdra. The distinction was now most sharply drawn between the three 'upper' *varṇas*, the Brāhmaṇa, Kṣatriya and Vaiśya on the one hand and the fourth, the Śūdra, on the other. In fact, the idea of separation between the *varṇa*-bound society (the *caturvarṇa*) on the one hand and the outsiders on the other appears to have emerged.

This fifth division comprised diverse groups of people which were usually considered as unclean and unsanctified and was thus regarded as standing beyond the pale of the society. It was only from a negative point of view, their non-inclusion within the bounds of the society, that they bore some semblance of cohesiveness. An attempt to give them a block character can perhaps be found in the concept of *pañcajanāḥ*, which according to an interpretation recorded in the *Nirukta*[66] stood for the four *varṇas* and the *Niṣādas*. *Niṣāda* thus sometimes signified not an individual tribe but a common name for all the hunting-gathering tribes that

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refused to take to agriculture as a means of living.[67] The *Aitareya Brāhmaṇa*[68] relates the interesting story that, on the adoption of Śunahśepa by Viśvāmitra as his son and spiritual heir some sons of the sage refused to accept the leadership of Śunahśepa. These recalcitrant sons were banished by Viśvāmitra, and some of the hunting-gathering tribes like the Andhras, Mūtibas, Śabaras, etc., descended from them.[69] The co-existence of two modes of living, agrarian and hunting-gathering, and the resultant tension between the two, which remained a permanent feature of Indian history, had already begun during the Vedic period.[70] An outsider was also one who spoke a strange language; it is in this sense that the expression *mleccha* is used in the *Śatapatha Brāhmaṇa*.[71]

Stratification and ranking arose and developed under the impetus of a deepening of settled life and a growing diversification of economic activities.[72] Simultaneously an expansion of territoriality was also taking place. Political and social organizations could not afford to remain limited by lineages but had to look for wider networks which gave rise to a more complex texture of the society. *Kula, gotra* and *vaṁśa*, although they strove to retain their sense of pride, exclusiveness and continuity, were weaving new alliances and seeking wider identities. Thus the *kulapa*, the head of the family, in a verse in the *Ṛgveda*, has been described as a comrade of and attendant on the *vrajapati*.[73] The *vrajapati*, like *vratapati*, was apparently a leader or a chieftain of a war band or clan.[74]

A *grāma* sometimes consisted of a single clan; the *Śatapatha Brāhmaṇa* tells us that Śaryata Mānava had been wandering about with his 'village' (*grāmena*), who obviously were his kin.[75] But all villages were not mono-clan settlements and the leader of a village often was a *vaiśya*.[76] Larger groups like *visa* and *jana* were subsuming the households (*gṛha*).[77] And *raṣṭra, rājya, sāmrājya* were arising as new and ever-larger political entities.

From the crucible of these changes, the *varṇa-jāti* system was taking shape. Similarities of occupation and interests brought independent families and clans together, which coalesced into larger identities. Thus Bhṛgus and Aṅgirasas combined to form Bhṛgvaṅgirasas. Several such priestly clans must have created the nucleus of the Brāhmaṇa *varṇa*. The desire to conform to and perpetuate the past traditions of one's ancestors introduced the element of heredity which gathered, it appears, more and more strength as time passed to give the system its most marked feature. Uddalaka Aruni said to his twelve-year-old son, Śvetaketu: 'Live the life of a student of sacred knowledge. Verily, my dear, *from our family there is no one unlearned* [in the Vedas], a Brāhmaṇa by connection [*brahmabandhu*] as it were.'[78] The preponderance in the use of patronymic expressions for naming peoples shows how important descent was considered.[79]

However, social divisions were not yet totally rigid and based exclusively on birth. Merit and conduct could offset disadvantages of birth, Kavasa Ailusa, according to the Aitareya Brāhmaṇa was the son of a slave woman and was reproached on account of his low birth by other priests.[80] He was, however, the composer of a number of *Ṛgvedic* hymns and by the power of his hymns he is said to have induced the holy Sarasvatī to flow into the desert.[81] Similarly Medhatithi taunted his half-brother Vatsa as the son of a *dāsī*; the latter proved his unblemished character by walking through fire.[82] The most edifying example of such liberal attitudes is found in the *Chāndogya Upaniṣad* where the great sage Gautama Haridrumata took Satyakāma, the son of the slave girl Jabala, as his pupil even though it was not known who the father of the boy was.[83] It seems to have been a current practice that ṛṣihood did not necessarily depend on birth; it could also be attained through learning and piety.[84]

In matters of marriage also, the rules were perhaps not very rigid. Marriage between Brāhmaṇa priests and Kṣatriya princesses was not uncommon.[85] Even the priestly office perhaps, was originally not considered a monopoly of Brāhmaṇas; there survives at least the memory of one instance in which a Kṣatriya prince acted as a priest in a sacrifice for his younger brother.[86]

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Nevertheless, *varṇa* distinctions were becoming more and more pronounced. The classical formulation of the theory of fourfold *varṇas* made its appearance in the famous *Puruṣasūkta* of the *Ṛgveda* and then is found in the *Atharvaveda* and other Vedic texts.[87] The usual names of the four *varṇas* are given as Brāhmaṇa, Rājanya, Vaiśya and Śūdra and later as Brāhmaṇa, Kṣatriya, Vaiśya and Śūdra. Often, only the three upper *varṇas* like Brahma, Kṣatra, Viś are mentioned.[88] 'The ritual literature is full of minute differences respecting the castes. Thus, for example, the Śatapatha prescribes different sizes of funeral mounds for the four castes. Different modes of address are laid down for the four castes, as *ehi*, 'approach', *āgaccha*, 'come', *ādrava*, 'run up', *ādhāva*, 'hasten up', which differ in degrees of politeness.[89] The fourth *varṇa* was gradually being barred from participation, except when required to render certain services to rituals, in the sacred rites and ceremonies. The *Śatapatha Brāhmaṇa*, for example, forbade a consecrated Brāhmaṇa (*dīkṣita*) from addressing a Śūdra[90] and a Śūdra was not allowed to milk a cow if the milk was to be used for *Agnihotra*.[91] On the other hand, a Śūdra participated in a mock fight with an Ārya as part of the *Mahāvrata* ceremony. Of course the Śūdra had to act as the defeated contestant.[92] In the *Viśvajit* sacrifice the ritual demanded that the sacrificer resided at the locality of the Niṣādas for some time.[93] It appears that in the religious domain the Śūdras were gradually being marginalized.

A passage in the *Aitareya Brāhmaṇa* has been taken to suggest that the *varṇas* occupied distinct positions in the political space.[94] It depicts the positions of the Brāhmaṇas, Vaiśyas and the Śūdras but is silent about that of the Kṣatriyas. Thus it appears that the passage reflects the point of view of the *kṣatra* or the political power.[95] The Brāhmaṇa is described as *ādāyī* (receiver of gifts), *ādpāyī* (drinker of soma), *āvasāyī* (seeker of food) and *yathākāma-prayāpyah* (liable to removal at will). A Vaiśya is called *anyasya balikṛt* (tributary to another), *anyasyādyaḥ* (to be lived on by another) and *yathākāmajyeyah* (liable to oppression at will). The description of the Śūdra is given as *anyasyapreṣyaḥ* (servant of another), *kāmotthāpyah* (to be expelled at will) and *yathākāmavadhyah* (liable to killing at pleasure).[96] One must, however, hasten to add that a literal rendering of the passage and interpreting the passage as if reflecting an actual state of affairs may be a somewhat risky exercise. The possibility that such an interpretation is likely to be exaggerated cannot be discounted. The passage may only represent the attitude of one social group to another, underlining the perception of 'we', 'they' difference; why 'me' would not like to be 'they'. In such a situation the disadvantages of being 'they' tend to get magnified. The passage occurs in a context where it is suggested that a Brāhmaṇa-like, Vaiśya-like or a Śūdra-like son is not suitable for a Kṣatriya. Moreover, the statement that Śūdras could be killed at will and that they had no right even to life seems rather unlikely. But at the same time there is no gainsaying the fact that hierarchy was becoming ever more pronounced.

Although the hereditary character and rigidity of occupational distinctions had not yet become inviolable, generally speaking, the four orders were thought of as representing different estates: the Brāhmaṇas spiritual-intellectual; the Kṣatriyas political-military; the Vaiśyas production; and the Śūdras service.[97] And while hierarchy was growing stronger, separation between the orders was widening.

Thus it was, in a society of mounting importance of kinship networks and peer groups, that the coming of age of a child took place. Education not only meant gaining formal instruction and acquisition of skills, but also learning one's social obligations, which would prepare one for entering the life of a householder (*gṛhapati*).

Marriage symbolized entry into the life of adult responsibilities. Although the theory of the schematic divisions of human life into four *āśramas* had not yet gathered force,[98] the importance of marriage was well appreciated and emphasised; it was on its way to becoming the central limb in the Indian notion of social arrangements. Marriage appears to have been a partnership between two persons, the *dampati*. The dominance of the husband, though perceptible, was perhaps not as preponderant in the Vedic society as it gradually became later.

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It has been noted that in the *Ṛgveda* the expression *dampati* signified 'the lord of the house', the *paterfamilias*; but it also meant both 'the master and the mistress' of the house.[99] The use of the word *pati*, i.e., 'the master' for husband originally was meant to define his position in relation to house; *pati* was the same as *dampati* (lord of the house). Later, the expression *pati* came also to signify husband's mastery over wife. It indicated an extension of the original meaning of the word and marked a change in gender relationship. It also had something to do with the growth of the institution of private property. It may also perhaps be surmized that the original meaning of the word *patni* was not merely the woman of the 'master', but the meaning was 'mistress' or 'lady master'.[100] The *Śatapatha Brāhmaṇa* states that wife is the half of her husband[101] and the *Bṛhadāraṇyaka Upaniṣad* that without a wife a man is incomplete.[102] In the description of various parts of a house in the *Atharvaveda* we find an apartment designated as *patnīnāmsadana*. We do not find reference to any exclusive area earmarked for their male counterparts.[103]

Conjugal harmony, virtuous life, and prosperity amidst sons and daughters, were the ideals of a fulfilled married life. 'O Gods with constant drought of milk, husband and wife with one accord press out and wash the soma juice ... Never do they deny or seek to hide the favour of the Gods .... With sons and daughters by their side they reach their full extent of life both decked with ornaments of gold. Serving the Immortal One with gifts and sacrificial meal and wealth, they satisfy the claims of love and pay due honour to the Gods.'[104] Wedding ceremony and marriage ritual have been described in some detail in a Ṛgvedic *sūkta* describing Sūryā's wedding.[105] It appears that the Vedic marriage ceremony in its essentials was not different from the later-day Hindu marriage ceremony. The wedding took place at the house of the bride; her parents and the relatives received the groom and groomsmen. The bedecked bride was given to the groom with accompanying rituals performed by Brāhmaṇa priests amidst feasts and festivities. The acceptance of the bride was symbolized, presumably, by a ceremony known as 'taking the hand' (*hastagrābha*).[106] 'I take thy hand in mine for happy fortune that thou mayst reach old age with me, thy husband. God Aryama, Bhaga, Savitar, Purandhi have given thee to be my household's mistress.'[107] The bride was then ceremonially taken to her husband's home. 'Mount this gold-hued [chariot], with strong wheels, fashioned of Kimsuka and Salmali, light-rolling, bound for the world of life immortal. Sūrya: make for thy lord a happy bridal journey.'[108]

Many of the later restrictions in marriage relations like those relating to *gotra, sapiṇḍa*, etc., had either not yet developed or had not developed to the same degree as found represented in the *Sūtra* literature. However, Vedic society was far from a promiscuous society and rules regarding connubium were developing towards the form they took on later. The famous dialogue of Yama and Yamī in the *Ṛgveda* shows the strong disapproval with which incest was held.[109] The view of scholars like Weber that the hymn indicates that marriage between brother and sister was previously current and that it had fallen into disuse only recently is untenable. Yama repeatedly asserts that the practice was considered sinful by gods and Asuras.[110] Even the logical formulation of the origin of human beings from an incestuous pair has been refuted by Yama in the course of his spurning of the advances of Yamī. 'Who knows that earliest day whereof thou speakest? Who hath beheld it? Great is the law of Varuṇa and Mitra. What wanton! wilt thou say to men to tempt them?'[111] Incest was viewed as individual deviant behaviour rather than a remnant of an old social custom. 'Sure there will come succeeding times when brothers and sisters will do acts unmeet for kinsfolk. Not me O fair one, seek another husband and make thine arm a pillow for thy consort,' reasons Yama to Yamī.[112]

It was considered improper for a younger brother or sister to marry before the elder brother or sister was married. Social custom regarded these marriages as undesirable supersession. A number of censorious terms expressing such passing by like *parivividhāna*,

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agredadhuṣ, agredidhisu, parivitta, etc., are found in later Saṁhitās and Brāhmaṇas. Norms and etiquettes regarding marriage were thus rather on the stricter side than on the lax promiscuous side.[113] Remarriage of a widow was not forbidden. It is not possible, however, to determine whether such marriages were common and took place as a matter of course. It appears that a widow could marry again, presumably for continuing the line of descent, and in these marriages the widow normally chose the younger brother of the deceased husband.[114]

A number of examples of polygamy occur in the Vedic literature. Presence of more than one wife is suggested, in some cases explicitly, in numerous verses of the Ṛgveda.[115] Manu, it is said, had ten wives;[116] Yājñavalkya, the great Upaniṣadic teacher, had two wives, Kātyāyanī and Maitreyī.[117] 'Moreover, the king regularly had four wives attributed to him, the Mahiṣī, the Parivṛkti, the Vāvātā and the Pālāgali.' The Mahiṣī appears to be the chief wife, being the first one married according to the Śatapatha Brāhmaṇa. The Parivṛkti, 'the neglected' is explained by Weber and Pischel as one that had no son. The Vāvātā is the 'favourite', while the Pālāgali is, according to Weber, 'the daughter of the last of the court officials.'[118] The names and descriptions of these queenly 'quartettes' are too trite, too obviously contrived to be real and it is not at all necessary to believe that all rulers had four wives and that each wife conformed to a type. But it can hardly be contested that polygamy was a feature of Vedic society, especially among the wealthy and powerful. Sometimes perhaps more than one bride was married to the same bridegroom in one single ceremony. In *Ṛgveda* X.43.1, there is a possible reference to such a wedding.[119] In a society where wars and raids were frequent, brides were occasionally captured. An echo of such a marriage can be detected in the following Ṛgvedic verse: 'Indra hath taken and possessed all castles, like as one common husband doth his spouses.'[120] Multiplicity of wives did perhaps reflect the wealth and power of the husband but it did not always lead to domestic bliss. 'Like rival wives on every side enclosing ribs oppress me sore', laments a Vedic poet.[121]

The wife usually was accorded a honoured position in her husband's family. Theoretically, at least, she was emphatically the mistress of the household. 'Over thy husband's father and thy husband's mother bear full sway, over the sister of thy lord, over his brothers rule supreme'; so runs a benediction to a bride.[122] Such a position presumably could be enjoyed by the wife of the eldest son with old parents and unmarried younger brothers and sisters. The daughter-in-law was expected to treat her parents-in-law with respect and kindness.[123] The precedence of the wife over her husband's sisters was not undisputed. In the *Aitareya Brāhmaṇa*, there is a passage which seems to suggest that some people held the view that, on certain ceremonial occasions, presumably in sharing ritual family meals associated with a funeral, sisters should be given precedence over wives because the sisters were of the same blood whereas wives were born of 'another's womb' (*anyodarya*).[124] Normally, however, the wife was a regular partner in the ritual offerings of the husband. Anyway, there can be little doubt that in the Vedic society the wife was regarded as the pivot of the household and therefore, she was advised to be sweet-tempered. As in later ages in India, during the Vedic period too, obedience and submissiveness were considered as great wifely virtues—the *Aitareya Brāhmaṇa*[125] praises a wife who 'does not protest' (*aprativādinī*).

Bearing children, especially male children, was regarded as the main role of a wife.[126] Lack of a son (*avirata*) was a misfortune similar to that of poverty (*amati*).[127] As the wife made possible the continuation of the line of descent by bearing children she was affectionately called *jāyā*—she, through whom one is born again.[128] It is possible that the appellation *patnī* emphasized the wife's role as partner in domestic duties, especially religious duties, the appellation *jāyā* underlined her role in procreation.[129]

The birth of a son was preferred to that of a daughter.[130] The *Aitareya Brāhmaṇa* says that while the birth of a daughter was a misery that of a son was a delight.[131] However, these statements should not perhaps be taken on their face value; they were true only in a limited

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sense which had a bearing mainly in the religious field. The birth of a son ensured performance of funeral ceremonies and continuation of the line of descent. Hence the preference. In fact, sonless fathers perhaps recoursed to the continuation of line of descent through the custom of *putrikāputra*. In such cases the daughter was given in marriage on express terms that her sons would perform the funeral rites for her father.[132] There are no evidences to suggest that daughters were greatly discriminated against. As children, girls were brought up more or less in the same manner as boys. In educated families girls were given good education. Some composers of Vedic hymns were women. Women shared the excitement of intellectual life embodied in the Upaniṣads in equal measure as men. Maitreyī, the wife of the famous teacher Yājñavalkya, spurning the lure of material comfort, said, 'What shall I do with that through which I may not be immortal?'[133] In philosophical debates Gārgī Vācakanavī could hold forth on equal terms with the most astute of thinkers.[134] In the field of politics, however, women played little role. Men go to the assembly, not women, says the Maitrāyanī Saṁhitā.[135]

Despite these brilliant instances in which women shone in intellectual life, it was the home and the hearth that were considered as their proper domain. And the Vedic attitude towards women was practically the same as in later-day Hindu society. It was a curious mix of contradictions. She was idealized on the one hand as the centre of family and household and was run down on the other as the symbol of dark passions, evil, depravity and deceit. The *Maitrāyanī Saṁhitā* categorises women among the three evils; the other two being dice and drink.[136] She was also identified with 'untruth'[137] and was associated with calamity (*nirriti*).[138] She was 'superior to heaven' and the 'gate of hell'.

Social realities both in their normative and formal aspects impinged on the life of a householder more powerfully than they did on the life of a child or a young student. The rules of conduct and behaviour also often represented the operation of power in the society. Success in social transaction thus, to a large extent, depended on the knowledge of these rules and norms.

It seems to have been the priestly order, the Brāhmaṇas, who had these rules more sharply defined than others and they were also perhaps the earliest to have assumed a distinctive group character. It seems natural that priestly order should have crystallized into a differentiated group before others; the Viś or the folk were an amorphous collection which received a very loose group character of the only after the formation of the Śūdra Varṇa and the group character of the Viś or Vaiśya *varṇa* always remained a little nebulous and negatively obtained by an assertion of separation from Śūdras with whom they shared a number of occupations.[139] Even the Kṣatriyas or the Rājanyas, representing political order, did not have the same degree of cohesive possibilities as the priestly order. Political and administrative power did not reside in a particular group in the same way as the priestly function. Political power remained divided between the ruler (*rājan*), nobles (*rājanaya*), and assemblies (*sabhā, samiti*).

In the Ṛgveda, Brahmana/Brāhmaṇa was a hymn maker and priest.[140] He was a repository of religious lore and wisdom as well as an expert in performance of rituals. Performance of rites not only ministered to the welfare of individual worshippers, they also catered to public good. The role of priests in serving what was regarded as essentially the interest of the community that really paved the way for the social ascendancy of the Brāhmaṇas. This public role finds voice in several passages in Vedic literature; the concept and function assigned to the *purohita* mainly underline that role.[141] In the *Atharvaveda*, for example, we find the passionate utterance of a priest: 'May this prayer of mine be accomplished; may perfect vigour and strength, may perfect, unceasing, and victorious power accrue to those whose Purohita. I am, I perfect their kingdom, their might, their vigour, their strength.... Let their energies be perfected, O bounteous one; let the roar of the conquering

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heroes arise ... let the divine Maruts, with Indra as their chief, go with the army.'[142] The *Śatapatha Brāhmaṇa* describes the duties of Brāhmaṇas as maintaining purity of descent (*brāhmaṇya*), the practice of actions befitting their group (*pratirūpa caryā*) and the perfecting of the people (loka-pakti).[143]

Brahma-Varcasam, the spiritual lustre, symbolized the ideal of Brāhmaṇahood.[144] This could be attained through a rigorous training of mind and conduct and performance of sacred rites.[145] Knowledge and conduct were the source from which the prestige of Brāhmaṇas flowed and these were the twin objects which were most seriously pursued by them. Vedic literature is filled with instances of the pains taken and the readiness and devotion shown by Brāhmaṇas in gaining and refining knowledge. Brāhmaṇas would undertake long journeys, would engage in learned disputations (brahmodya).[146] Uddalaka Aruni, a Kuru-Pāñcāla Brāhmaṇa, in an episode narrated in the *Śatapatha Brāhmaṇa,* is said to have been wandering through the Northern Country seeking such learned engagements.[147] Kings often arranged scholarly debates.[148] There was both pride and arrogance among many of these scholarly Brāhmaṇas, but at the same time there was a touching modesty among them for they accepted defeat with grace asking with humility to learn from the victor.[149] They would even humbly accept non-Brāhmaṇa learned Kṣatriyas as teachers for the sake of knowledge.[150] Accepting Kṣatriyas as teachers in theological matters on the part of Brāhmaṇas could not have been an easy decision. The Brāhmaṇas had to swallow their pride before asking a Kṣatriya to teach them, for the Brāhmaṇas regarded, not altogether without justification, that theology was their special province. Once King Janaka of Videha exposed the deficiency of great scholars like Śvetaketu Aruneya, Somasusma Satyayajni and Yājñavalkya in their knowledge of the Agnihotra rite. In chagrin the Brāhmaṇas said, 'Surely, this fellow of a Rājanya has out-talked us: come let us challenge him to a theological disputation!' Yājñavalkya said, "We are Brāhmaṇas, and he is a Rājanya: if we were to vanquish him, whom should we say we had vanquished? But if he were to vanquish us, people would say of us that a Rājanya had vanquished Brāhmaṇas: do not think of this!" They approved of his words.'[151] That even famous Brāhmaṇa scholars, pocketing their pride, accepted Kṣatriyas as teachers surely points to the commitment they felt towards knowledge. Naka Maudgalya held that study and teaching were the true penance (*tapas*).[152] A teacher was expected to teach his students wholeheartedly and normally he was expected to reveal everything that he knew to his students.[153] However, there were certain kinds of knowledge, of highly esoteric nature, which could not be revealed to all and sundry; such knowledge could be revealed only to those who were worthy of receiving it.[154]

It must have been the exceptionally motivated ones and ones that were fortunate to possess the requisite resources who wandered about the country seeking knowledge. But even for the more sedentary and domesticated ones, constant brushing-up and self-culture (*svadhyāya*) were recommended.[155] 'The study and teaching [of the Veda] are a source of pleasure to him, he becomes ready minded, and independent of others.... He sleeps peacefully; he is the best physician for himself....'[156] 'And should he be altogether unable [to study], let him at least read a single divine word; and thus he is not shut out from beings.'[157] The consciousness of a cultural and intellectual heritage had already grown quite strong by the time of the composition of the *Brāhmaṇas* and the need to preserve and develop that heritage was acknowledged and appreciated.[158]

It was a Brāhmaṇa's contributions towards public good, his role in education and religion, his service to *lokapakti* (perfecting the society) that made him entitled to special treatment. A grateful society, in response to the contributions of Brāhmaṇas, treated them with special consideration. This is how the privileges claimed by Brāhmaṇas have been justified in the *Śatapatha Brāhmaṇa.*[159] The privileges and immunities claimed on behalf of Brāhmaṇas in later Vedic texts were practically the same as are found in the *Smṛtis* which really

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amounted to inviolability of their life and property. They were also considered as the most worthy recipients of *dāna*. It was natural that Brāhmaṇas, along with Kṣatriyas, claimed primacy over common folk. Brāhmaṇas and nobles were described as 'better men'.[160] It was also natural that a certain amount of tension would develop between Brāhmaṇas and Kṣatriyas.[161] Instances of disputes between priests and their royal clients were not absent.[162] The standard of conduct expected of a Brāhmaṇa was indeed high; he was to be kind, generous and gentle.[163] A false Brāhmaṇa, a Brāhmaṇa only by birth (Brahmabandhu), was an object of ridicule.[164] An ignorant Brāhmaṇa deserved no favoured treatment and could be despoiled in course of an Aśvamedha sacrifice.[165] Privileges, so it was conceived, were contingent on attainments and character and did not come automatically through birth alone.

The expression Kṣatriya is not very extensively used in the *Ṛgveda*;[166] and in the text it is exclusively used to denote royal authority and is frequently associated with gods as their attribute. The expression Rājanya occurs only once in the *Ṛgveda* in the famous *Puruṣasūkta*. In the later *Saṁhitās* and *Brāhmaṇas* the terms Kṣatriya and Rājanya are much more common and they seem to signify, by now, a distinct class of nobility, those who partake of royalty.[167] In the post-Ṛgvedic works these two terms became practically synonymous.[168] It cannot be said with any certainty whether these terms originally were of distinct import or whether Rājanya denoted the group wielding ruling authority and *Kṣatra* denoted the attribute of the Rājanyas, i.e., the power to rule.

Neither can it be ascertained whether the Kṣatriya/Rājanyas represented the remnants of an aristocratic form of government supplanted by monarchy or they represented the emerging power of the nobles growing at the expense of the powers of the monarch. The original nature of Vedic kingship remains somewhat vague; contradictory indications of elective and hereditary kingship are both available in Vedic literature.[169]

Whatever might have been the nature of their origin, the Rājanya/Kṣatriyas, along with the Brāhmaṇas, came to be looked upon as a distinct social group. This must have happened before the composition of the *Brāhmaṇas* for in *Brāhmaṇa* literature the group identity of the Rājanya/Kṣatriyas is taken for granted. In fact, one of the recurrent themes underlying the liturgical texts is the drawing of distinctions between the three orders—the priestly, the lordly and the common folk.[170] The mutual relations between the three, the tension and friction, the dependence and cooperation are found vividly represented.[171] Although the Kṣatriyas were counted among *ahutāda*, non-eaters of obligations, along with the commoners, their superiority, their higher station, their authority over the *Viś* have been strongly and repeatedly underlined.[172]

The duty and function of Kṣatriyas was protection, of people and state. Thus a Kṣatriya was a fighter; the distinctive marks of his identity were the bow and arrow, the chariot, the breast-plate.[173] A good Kṣatriya meant a good archer and chariot-fighter.[174] However, it does not mean that all soldiers were Kṣatriyas; people other than Kṣatriyas were regularly enlisted in the army. It also does not mean that Kṣatriyas 'included the mere fighting men'.[175] The Kṣatriya was a fighter because he partook of rulership; Indra and Varuṇa were the deities that symbolized Kṣatriyahood.[176] Rulership was symbolically represented as building upwards, layer by layer, as it were, the body social.[177] Thus administration and judicial functions also attached to Kṣatriyas.[178]

Their exalted status and the importance of their role and function, accorded to the Kṣatriyas the right to live on the people. The folk have been described as the food of the Rājanyas.[179] The people were expected to 'serve, from a lower position, the Kṣatriya seated above them.'[180] In actuality, however, this relation-ship was not so placid; the Viś did not always behave as a meek, servile lot, habitually rendering obedience to the Kṣatriyas. The authority of both the 'priestly and 'lordly' powers, the *Kauṣītaki Brāhmaṇa* tells us, was unstable; stability

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was the attribute of the subjects.[181] The Kṣatriyas, it appears, would like to maintain cordial relationship with the Viś and would strive to make themselves acceptable to the people. Despite the efforts, occasional feuds between the people and nobility broke out with damaging consequences for the Kṣatriyas.[182]

We have already noted above that Vedic literature records instances of highly refined rulers and princes with sharp intellectual and sound scholarly attainments. Their contributions towards the intellectual life of Vedic society must have been considerable. However, the area of predominant Kṣatriya interest was administration and warfare. The ruler relied heavily on the support and advice of his kin and clansmen.[183] Agriculture, trade and commerce did not seem to interest the Kṣatriyas very much.[184]

The common folk or subject population who belonged neither to the priestly order nor to the nobility originally constituted the mass of people called Viś.[185] Viś thus were frequently contrasted with *Rājan*... Viś owed obedience to king,[186] took refuge in him,[187] brought tribute to him.[188] In the *Atharvaveda* we find prayers to make the king's rule over people secure... king to be made the lord of Viś,[189] the sole ruler of people.[190] In the same vein in other passages, the king is advised to make himself desirable to the people.[191] Protected by the king, the common folk followed their vocations and paid tribute to him.[192]

It was the Viś who formed the material basis of society and provided its economic necessities. The major occupation of the common folk was agriculture, though pastoralism continued.[193] Some of them pursued trade and commerce too. *Paṇis* seem to have been prosperous traders. They were censured in the Vedas for they did not pay *dakṣiṇā* to Brāhmaṇas and did not make offerings to gods.[194] The Viś were thus not a mass of undifferentiated multitude; a number of professions and crafts with distinctive characteristics had emerged. Carpenter is frequently referred to in the *Ṛgveda*.[195] *Rathakāra*, though not mentioned in the *Ṛgveda*, is given a position of importance along with *karmāra* in the *Atharvaveda* in connection with the selection of a king.[196] Kings sought the help of artisans and they are put on par with kings, kingmakers and *grāmaṇī*.[197] There seems little doubt that artisans in early Vedic society enjoyed an honourable position. Along with priests and nobility, these practitioners of special and essential services shared the leadership of society.

Productive activities of Vedic society were carried on almost exclusively by Viś; they were the feeders of society. Thus they are described as tributary to others (*anyasya balikrit*), to be lived on by others (*anyasyādyah*) and fit to be eaten.[198] Though primarily engaged in economic functions, at the time of war Viś supplied the bulk of the fighting force. The leadership of the army, however, lay in the hands of Kṣatriyas.[199]

During the later Vedic period, the period covered by the *Yajus Saṁhitās* and *Brāhmaṇas*, compartmentalization of society proceeded further. On the one hand Brāhmaṇas and Kṣatriyas grew into dominant sections of the society, claiming a number of privileges; on the other a new order, that of the Śūdras, emerged and got absorbed in the social scheme as the fourth varṇa.[200] Pushed from above by the Brāhmaṇa and Rājanya-Kṣatriyas and pressed by the Śūdras from below, the loosely formed Viś developed into the Vaiśya *varṇa*, desperately trying to keep their separate identity intact against the inroads of Śūdras, with whom they shared a number of functional similarities. Occupational distinctions between themselves and Śūdras not being wide and marked enough, the Vaiśyas relied more and more on ritualistic and sacramental differences to gain ascendancy over the Śūdras.[201]

Cultivation and cattle-rearing were regarded as the representative vocations of a Vaiśya. The *Taittirīya Saṁhitā* says that the Vaiśyas were created, along with the *Jagatī* metre, the *Viśvedevas* and the cow. 'Therefore they are to be eaten for they were created from the receptacle of food.'[202] Similarly, the *Aitareya Brāhmaṇa* writes, 'The Vaiśya is connected with the *Jagatī*, the cattle are connected with the *Jagatī*, verily thus with cattle he makes him

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prosper.'[203] A Vaiśya is described as 'nourisher' (*posayiṣnu*).[204] This is a reference to his association with food production. Pusan is also associated with Vaiśyas.[205]

The class of artisans has been increasing both in number and diversity along with the growth and diversification of the economy—the list of victims to be sacrificed in the *puruṣamedha* represents a wide spectrum of crafts and professions.[206] The position of this professional class in the social scheme is difficult to determine; before the emergence of the Śūdra *varṇa* they must have belonged to the Viś, but the picture changed somewhat after the formation of the fourth *varṇa* and the Śūdras also followed craft and industrial vocations. The *Jaiminīya Brāhmaṇa* refers to the exclusive preserve of Vaiśyas.[207] A Śūdra could be a prosperous and owner of many cattle.[208] In the *Bṛhadāraṇyaka Upaniṣad,* the Śūdra is called *pūṣan* or nourisher, an obvious reference to the Śūdra's association with food production.[209]

The occupational distinctions between the Vaiśya and the Śūdra was thus rather thin. A Śūdra was considered unfit for participation in sacrifice;[210] at the *agnihotra* he was forbidden to milk the cow for oblation.[211] A man consecrated for sacrifice (*dikṣita*) was advised not to speak to a Śūdra.[212] A Śūdra was not allowed to drink soma.[213] There were no such restrictions in the case of Vaiśyas. In connection with the *rājasūya* sacrifice, the *Aitareya Brāhmaṇa* states that a Vaiśya could ask for a place of sacrifice from the ruler just as a Brāhmaṇa or a Rājanya would.[214] He was also allowed participation in the sprinkling ceremony.[215] And the Vaiśyas always enjoyed the right to education and *upanayana*; in the *Chāndogya Upaniṣad* a famous student is said to have been the glory of Brāhmaṇas, Rājanyas and Vaiśyas.[216]

Notionally, Śūdras seem to have been regarded as representing the grey area between the 'society' proper, comprising the Brahman, Kṣatra and Viś, and the 'outside tribal world', symbolized by the Niṣādas, Śabaras, Mūtibas, etc.[217] The Śūdras also perhaps provided the corridor through which the tribes were given passage to the body social. The basis of distinctions between orders of society was predominantly ritual and cultural modes. These distinctions also had occupational and economic underpinnings. If the notion of hierarchy and exclusiveness of social groups were growing on the one hand, a sense of interdependence was also growing on the other. The Vedic point of view was pluralistic, not only in its conception of the pantheon, it was also pluralistic in its social outlook.[218]

NOTES AND REFERENCES

1. *Atharvaveda*, XIV.2.13. Sūkta 85 of the *Ṛgveda* and *Kāṇḍa* 14 of the *Atharvaveda* give interesting details on ideals of marriage and marriage ceremony during early Vedic period.
2. *Ṛgveda*, X.18; R.T. Griffith, *The Hymns of the Rigveda*, Delhi, 1986, p. 542.
3. *Ṛgveda*, I.189.2-4; Griffith, op. cit., p. 127.
4. For example, a random set of samples from *Maṇḍala* I: 23.24; 54.11; 85.12; 94.8; 111.2; 117.25; 129.7.
5. *Ṛgveda*, X.183.
6. Interpretation of Roth, from the root *dam*, 'control', A.A. Macdonell and A.B. Keith, *Vedic Index*, Vol. I, Delhi, 1968, p. 340, sv. *dama*. However, see note 2, ibid. Even if the word was derived from a root meaning 'to build', the sense of the nest remains.
7. *Vedic Index*, I. p. 340.
8. *Śatapatha Brāhmaṇa*, II.5.2.14; II.6.2.4; III.4.1.6; XII.4.1.4.
9. *Ṛgveda*, VII.55.5.
10. *Ṛgveda*, X.85.42-46.
11. For references to these terms see *Vedic Index* under the relevant terms.
12. Contrast these terms with the Western 'cousins' and 'uncles'.
13. *Atharvaveda*, VI. 11.3; VIII.6.25; *Aitreya Brāhmaṇa*, VII.15.
14. *Bṛhadāraṇyaka Upaniṣad*, 6.4.24-28; R.E. Hume, *The Thirteen Principal Upaniṣads*, London, 1975, pp. 172-4.
15. Ibid.

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16. *Vedic Index*, I, pp.443-4.
17. *Aiteraya Brāhmaṇa*, VII.14; *Pañcaviṁsa Brāhmaṇa*, XXII. 14.3.
18. *Pañcavimśa Brāhmaṇa*, XIV.7.2.
19. *Atharvaveda*, VI.140; *Taittirīya Saṁhitā*, VI.1.6.7; *Śatapatha Brāhmaṇa*, VII.4.2.38.
20. *Vedic Index*, I, p.256, notes 1,2.
21. *Ṛgveda* I.38.1; V.43.7; VII 32.19, VIII.1.6; X.7.3; X.48.I
22. *Ṛgveda*, VII.1.6; Griffith's transalation.
23. The term, *niveśana* strongly suggests association with pastoral-nomadic life; *niveśana* in Vedic literature is often used to denote the resting place of animals in contrast with *gṛha*, the human dwelling place; *Vedic Index*, I, p.453. *Niveśana* probably was a carry-over from a nomadic past into the settled agrarian life of the Vedic society.
24. *Vedic Index*, I, p.230.
25. R.N. Nandi, Rigvedik Samaj Ek Punarvichara, *Itihasa*, no.2, New Delhi, 1993, p.78.
26. *Ṛgveda*, 2.41.5; 5.62.6, etc.
27. *Śatapatha Brāhmaṇa*, XIII.2.4.2; *Aitareya Brāhmaṇa*,
28. *Chāndogya Upaniṣad*, VIII.6.2.
29. *Jaiminīya Upaniṣad Brāhmaṇa*, III.13.4.
30. The society during the Vedic age, beginning with the Ṛgvedic itself, was predominantly agriculture-based; see Ramendra Nath Nandi, Rigvedik Samaj: Ek Punarvichar, *Itihasa*, Number 2, New Delhi 1993, pp.70 ff.
31. *Ṛgveda*, I.163.11; VI.24.10; *Atharvaveda*, II.4.5; XII.1.56; *Śatapatha Brāhmaṇa*, XIII, 6.20. etc.
32. *Chāndogya Upaniṣad*, VIII.5.3.
33. *Ṛgveda*, X.146 *Sukta* to *aranyani*.
34. *Vedic Index*, I. p. 245.
35. Vestiges of pastoralism are especially strong in early Vedic literature. For recent and divergent views on the character of Vedic economy see G.S. Ghurye, *Vedic India*, Bombay, 1979; R.S. Sharma, *Material Culture and Social Formations in Ancient India*, Delhi, 1983; Romila Thapar, *From Lineage to State*, Bombay, 1984; R.N. Nandi, op.cit., Suvira Jaiswal, Stratification in Rigvedic Society : Evidence and Paradigms, *The Indian Historical Review*, Vol.XVI, Nos.1-2, New Delhi 1993, pp. 1 ff. It is, however, pertinent to note that agriculture and farming are generally found as complimentary occupations of the same group of people and are rarely mutually exclusive.
36. *Ṛgveda*, I.83.1, IV.32.17; V.4.11; VIII.89.2, etc.
37. *Gaviṣti, gavya*, 'war for cows', *Ṛgveda*, I.91.23; III.47.4; V.63.5; VI.31.3; VI.18.7, etc.
38. *gopā janasya*, *Ṛgveda*, III.43.5; *gopati* is freely used in the Ṛgveda to denote any lord or master, *Vedic Index*, I, p.237; the expression *goptṛ* in the sense of protector is already used in the *Atharvaveda*, X.10.5.
39. See note 37; also see R.S. Sharma, From Gopati to Bhupati, *Studies in History*, Vol.II, no.2 (July-December 1980), pp.1-11.
40. For varieties of occupations occurring in Vedic literature, see *Vedic Index*, Vol.II, English index s.v. occupation.
41. *Ṛgveda*, VII.55.5; X.66.14; X.85.28; X.117.9; *Atharvaveda*, XII.5.44.
42. *Śatapatha Brāhmaṇa*, I.6.4.3.
43. IV.4.1.
44. *Ṛgveda*, I.164.33.
45. Cf. *Ṛgveda*, III.1.10; VIII.20.21; *Atharvaveda*, VI.15.2.; XV.8.2.3, etc.
46. Vedic Index, II, p.415.
47. *Ṛgveda*, I.109.1-2, Griffith's tr.; cf. *Ṛgveda*, I.113.2; *Atharvaveda* I.9.3; II.6.4; III.3.6; VI.5.2; VI.73.1; XI.1.6,7; *Kauṣītaki Brāhmaṇa*, XXV.15; *Pañcaviṁśa Brāhmaṇa*, XVI.6.9. etc.
48. *Ṛgveda*, X.191; *Atharvaveda*, III.30.4; VII.52.1; XI.1.26, etc.
49. *Chandogya Upaniṣad*, VI.1.2.
50. The form and the method of Brahmanical education devised during the Vedic age remained practically unaltered till the modern Western system supplanted it. For a concise account of this tradition see Daniel Ingalls', The Brahman Tradition', in Milton Singer, ed., *Traditional India: Structure and Change*, Jaipur 1975, pp.3-9.
51. *Ṛgveda*, X.109.5; *Atharvaveda*, XI.5; *Gopatha Brāhmaṇa*, I.2.1-8; *Chāndogya Upaniṣad*, II.23.2; IV.3.5; IV.10.2 seq; *Bṛhadāraṇyaka Upaniṣad*, VI.3.7.
52. *Ch. Up.*, VI *prapāṭhaka*.
53. *Ch. Up.*, VIII.7.3 for 32 years, VIII.15 for life.
54. The Upaniṣads mention a number of such Kṣatriya scholar kings.

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55. *Vedic Index*, I, pp.205-7.
56. G.C. Pande, *Foundations of Indian Culture*, Vol.II, Delhi 1990, p.126.
57. *Ṛgveda*, X.190.
58. *Ṛgveda*, X.85.1.
59. G.C. Pande, op.cit., Vol.II, pp.128-9.
60. *Ṛgveda*, VIII.35.16-18; in *Ṛgveda*, IV.50.8 also there is a clear reference to these three divisions, the priest, the ruler and the people. It has also been stressed that a similar three-fold division obtained in other Indo-European and Indo-Iranian societies as well, G.C. Pande, op.cit., pp.177-8.
61. of *Ṛgveda*.
62. J. Eggeling, The *Śatapatha Brāhmaṇa*, Part I, Sacred Books of the East Vol.XII, p.xvi
63. The *Ṛgvedic* verse IX.112.3, where a priest tells that his father was a physician, is well known. In *Ṛgveda*, I.112.11 there is reference to a seer, Dhirghasravas, who was a trader and who was the son of Usij. Usij, it has been said in later tradition, was a slave woman, *Vedic Index*, VolI, p.132.
64. *Atharvaveda*, VIII.10.24; Vedic Index, Vol.II, p.16.
65. Śaryāta Manava drove to the dwelling of the sage Cyavana, taking his daughter Sukanyā along, and gave her in marriage to the sage, *Satapatha Brāhmaṇa*, IV.1.5.2-7.
66. The interpretation by Aupamanyava, *Nirukta*, III.8.
67. *Vedic Index*, I, pp.453-54; cf., Sibesh Bhattacharya, Pluralism and Visible Path (Pratyaksha Mārga) and Early Indian Idea of Polity, Social Scientist, Vol21, No.12, December 1993, pp.6-7.
68. VII.18.2.
69. *Aitareya Brāhmaṇa*, 33.6.
70. See *Vedic Age*, ed. R.C. Majumdar, Bombay 1965, pp.264-5.
71. III.2.1.24; cf. *Vedic Index*, II, p.181.
72. The Transition from nomadic to settled life and the consequent changes in the social formation during early Vedic age has been analysed by Sacchidanand Misra, *Prachin Bharat Men Gram evam Gramya Jivan*, Gorakhpur 1984.
73. X.179.2l.
74. Sacchidanand Misra, op.cit., pp.72, 163-5.
75. *Śat.Br.*, IV.1.5.2-7.
76. *Tait. Sam.*, II.5.4.4; *Mait. Sam.*, I.6.5.
77. *Ṛgveda*, X.91.2.
78. *Ch. Up.*, VI.1.1.
79. For the use of patronymns see *Vedic Index* passim.
80. II.19.
81. *Ṛgveda*, X.30, Anukramani; cf. D.D. Kosambi, *An Introduction to the Study of Indian History*, Bombay 1975, pp.105-6.
82. *Pañcaviṁśa* Br., XIV.6.6.
83. *Ch. Up.*, VI.4.4.
84. *Tait. Sam.*, VI.6.1.4; *Kāthaka Sam.*, XXX.1; *Mait Sam.*, IV.8.1.
85. Sukanyā, the daughter of king Saryata married Cyavana, *Śat. Br.*, IV.1.5.7; Rathavithi's daughter married Syavasva, *Bṛhaddevata*.
86. Devāpi Ārṣṭisena had acted as *purohita* for Santanu according to the *Ṛgveda*, X.98. According to the *Nirukta*, Devapi was the elder brother of Śantanu and they were princes of the Kuru family. There is no valid ground for doubting this tradition as preserved in the *Nirukta*. What could be the motive for inventing this story by Yaska? Moreover, the very fact that Yaska mentions the story of Devapi's priestation for his younger brother, a Kṣatriya ruler, indicates that it was not considered as inherently implausible. Cf. *Ait. Br.*, VII.17.6 where Viśvāmitra is addressed as *rājaputra*.
87. *Atharvaveda*, XIX.6; *Tait. Sam.*, VII.1.1.4-6; *Pañcavimsa Br.*, VI.1.6-11.
88. *Vedic Index*, II, pp.252-3.
89. *Vedic Index*, II, p.253.
90. *Śat. Br.*, I.1.4.12.
91. *Śat. Br.*, XIII.6.2.10.
92. *Vedic Index*, II, p.390.
93. *Vedic Index*, I, p.454.
94. *Ait. Br.*, VII.29; *Vedic Index*, Vol.II, pp.255-6.
95. Sibesh Bhattacharya, *Indian Historical Review*, Vol.X, Nos.1-2, July 1983-January 1984, p.4.

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96. Many scholars, however, are of the opinion that the expression *Yathākāmavadhyaḥ* in the passage does not mean one who could be killed at pleasure, but rather one who could be beaten. We have here followed the interpretation of the authors of *Vedic Index*, II, pp.255-6.
97. Social organization during the Vedic period remains a controversial and nebulous area. Professor G.C. Pande has argued with cogency and force that Vedic society, to a large extent like Indo-Iranian and other Indo-European societies, was organized primarily around three orders: sacerdotal (*Brahma*), warrior (*Kṣatra*) and folk or commoner (Viś). He strongly refutes the contention that the Vedic notion of society was based on race and ethnic consciousness. In his opinion Vedic society was ordered on the notion of an organic whole sustained by ritual harmony. G.C. Pande, *Foundations of Indian Culture*, Vol.II, Delhi 1990, pp.176ff. Also see his interpretation of the *Ait. Br.* Passage quoted above, G.C. Pande, op. cit., p.189.
98. P.V. Kane, *History of Dharmaṣastra*, Vol.II, Pt.I, Poona 1974, pp.416ff; G.C. Pande, op. cit., pp.133-4.
99. *Vedic Index*, I, p.340.
100. Compare the retort of the Roman matron to her husband, 'Where you are master, I am mistress.' H.H. Scullard, *History of the Roman World, 753 to 146* BC, London 1969, p.355.
101. *Śat. Br.*, V.2.1.10.
102. *Br. Up.*, I.4.17.
103. *Atharvaveda*, III.3.4; *Vedic Index*, I, pp.230-1.
104. *Ṛgveda*, VIII.31.5-9.
105. *Ṛgveda*, X.85.
106. *Ṛgveda*, X.18.8.
107. *Ṛgveda*, X.85.36.
108. *Ṛgveda*, X.85.20.
109. *Ṛgveda*, X.10.
110. *Vedic Index*, I, p.475.
111. *Ṛgveda*, X.10.6, Griffith's tr. For a summary of the creation legends in early Indian literature and the supposed role of incest between father and daughter see Wendy D. O'Flaherty, *Hindu Myths*, Penguin Books, 1976, pp.25ff.
112. *Ṛgveda*, X.10.10.
113. *Vedic Index*, I, p.476.
114. In *Ṛgveda*, X.18.8 there is a possible and in *Ṛgveda*, X.40.2 there is a clear reference to the marriage of a widow with the brother of a dead husband. The practice continued in the Dharmasastra tradition; see Griffith, op.cit., p.542, note 8.
115. *Ṛgveda*, I.62.11; 71.1; 104.3; 112.19; 186.7; X.43.1, etc.
116. *Maitrāyanī Saṁhitā*, I.5.8.
117. *Bṛhadaraṇyaka Upaniṣad*, 2.4.1.
118. *Vedic Index*, I, p.478.
119. 'In perfect unison all yearning hymns of mine that find the light of heaven have sung forth Indra's praise. As wives embrace their lord, the comely bridegroom, so they compass Maghavan about that he may help'—*Ṛgveda*, X.43.1; Griffith's tr.
120. *Ṛgveda*, VII.26.3; Griffith's tr.
121. *Ṛgveda*, I.126.8.
122. *Ṛgveda*, X.85.46.
123. *Vedic Index*, I, p.485, notes 105, 106.
124. *Vedic Index*, I, p.285.
125. *Ait. Br.*, III.24.7; cf. *Gopatha Br.*, II.3.22.
126. *Ṛgveda*, I.91.20; 92.13; III.1.23; X.85 passim; *Atharvaveda*, III.23.2; V.25.11; VI.11.2, etc.
127. *Ṛgveda*, III.16.5.
128. *Ṛgveda*, IV.3.2; X.34.2; 3,13; *Ait. Br.*, III.23.1; *Śat. Br.*, IV.6.7.9.
129. *Vedic Index*, I, p.286.
130. *Atharvaveda*, VI.11.3.
131. *Ait. Br.*, VII.15.
132. *Vedic Index*, I, p.537.
133. *Br. Up.*, 2.4.3; Robert Ernest Hume, *The Thirteen Principal Upaniṣads*, London 1975, p. 98.
134. *Br. Up.*, Hume, op.cit., pp.1130-14, 117-19.
135. *Mait. Sam.*, IV.7.4.
136. *Mait. Sam.*, III.6.3.
137. *Mait. Sam.*, I.10.11.
138. *Ibid.*

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139. S.C. Bhattacharya, *Some Aspects of Indian Society from c. 2nd century BC to c. 4th century AD.*, Calcutta 1978, Chapter IV.
140. *Vedic Index*, II. pp. 77-78, 80-81; G.C. Pande, *Foundations of Indian Culture*, II. pp.181-2.
141. *Vedic Index*, II, pp.5-8, see especially the last paragraph on *Purohita* on p.8.
142. *Ath. Veda*, III.19.1-5.
143. *Śat. Br.*, XI.5.7.1.
144. *Tait. Sam.*, IV.1.7.1; VII.5.18.1; *Vaj. Sam.*, XXII.22; XXVII.2; *Tait. Br.*, III.8.13.1; *Ait. Br.* IV.11.6-9; *Śat. Br.* XIII.2.6.10; X.3.5.16; XI.4.4.1.
145. *Kath. Sam.* XXXVII.7; *Tait. Br.* II.7.1.1; *Śat. Br.* II.3.1.31; I.7.2.3; XI.3.3.3-6; 5.7.10.
146. *Śat. Br.* XI.4.1.1; *Br. Up.* III.3.1; III.7.1.
147. *Śat. Br.* XI.4.1 seq.
148. *Śat. Br.* XI.6.3.1; Br, Up. IV.1.1-9, 20, 29.
149. *Śat. Br.* XI.4.1.9; XI.5.3.13.
150. *Śat. Br.* X.6.2.5; *Br. Up.* II.1.1; VI.1.11; *Ch. Up.* I.8.1; V.3.1.
151. *Śat. Br.*, tr. J. Eggeling, *Sacred Books of the East*, Vol.44, pp.113-14.
152. *Tait. Up.* I.9.1; *Vedic Index*, II, p.86.
153. *Tait. Aranyaka*, VII.4; Śat. Br. XIV.1.1.26-7.
154. *Vedic Index* II, p.88, note 104; Śat. Br. XIV.1.1.19-26.
155. *Śat. Br.* XI.5.6.3 seq; *Tait. Aranyaka* II.13.
156. *Śat. Br.* Tr. Eggeling, *Sacred Books of the East*, Vol.44, p.99.
157. *Śat. Br.* XI.5.6.9.
158. *Śat. Br.* I.7.2.3; XI.5.6.3.
159. 'And the people that are being perfected guard the Brāhmaṇa by four duties—by [showing him] respect and liberality, [and by granting him] security against oppression and security against capital punishment.' *Śat. Br.* XI.5.7.1.
160. *Śat. Br.* II.4.1.10.
161. Sibesh Bhattacharya, Political Authority and Brāhmaṇa Kṣatriya Relationship in Early India—An Aspect of Power Elite Configuration, *Indian Historical Review*, X, 1-2, 1983-84, pp.1-20.
162. *Vedic Index* II, p.89.
163. *Śat. Br.* II.3.2.12; 3.4.6.
164. *Ait. Br.* VII.27; *Ch. Up.* VI.1.1.
165. *Śat. Br.* XIII.4.2.17.
166. It occurs seven times, vide *Vedic Index*.I, p.203, n.7.
167. *Ath. Veda*, VI.77.3.4; XII.5.5.44, 46; *Vaj. Sam.* XXX.5; *Ait. Br.*, VII.24; *Śat. Br.*, I.3.2.15; IV.1.4.5.6, etc.; *Vedic Index* I, p.203, n.5.
168. *Vedic Index* I, p.203, II, pp.216-17.
169. G.C. Pande, *Foundations of Indian Culture*, II, pp.248-50; *Vedic Index*, II, p.211.
170. For example, *Ait. Br.*, I.27-28; *cf.* Eggeling, *Satapatha Brāhmaṇa*, Part I, *Sacred Books of the East*, Vol.12, Delhi 1988 (Reprint), pp.XII-XIX.
171. A.K. Coomaraswamy, *Spiritual Authority and Temporal Power in the Indian Theory of Government*, Delhi 1978; J.C. Heesterman, *The Ancient Indian Royal Consecration*, The Hague, 1957. Also see Kumkum Roy, *The Emergence of Monarchy in North India*, Delhi 1994.
172. Kṣatriyas have been described as *ahutada* in *Ait. Br.*, VII.19; Śat. Br. IV.5.2.16; Kṣatriya served by Viś, *Śat. Br.* I.3.4.14-15; II.5.2.6; Kṣatriya lives on people, *Śat. Br.*, III.3.2.8; Viś bow down to Kṣatriyas, *Śat. Br.* III.9.3.7.
173. *Ath. Veda*, XVIII.2.60; *Śat. Br.* V.3.5.30; *Ait. Br.* VII.19.
174. *Tait. Sam.* VII.5.18.1; *Mait. Sam.* III.12.16; *Vaj. Sam.* XXII.2.
175. *Vedic Index* I, pp.203-04.
176. *Śat. Br.* VIII.4.3.10; X.4.1.5; see note 158 above.
177. *Śat. Br.* IX.4.3.3.
178. *Kath. Sam.* XXVII.4; cf. *Vedic Index* I, p.205, n.18.
179. *Śat. Br.* III.3.2.8.
180. *Śat. Br.* I.3.4.15; cf. II.5.2.6.
181. *Kausitaki Br.* XVI.4.
182. On the relationship between nobility and people see *Vedic Index* I, pp.204-05, especially notes 13 and 16. Feuds between Kṣatriyas and Viś might have been sometimes fanned by Brāhmaṇas, *Tait. Sam.* II.2.11.2; *Mait. Sam.* I.6.5; II.1.9; III.3.10, etc.

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183. *Śat. Br.* VII.1.1.8; XIII.8.3.19; Vedic Index I, p.207.
184. *Vedic Index* I, p.206.
185. *Vedic Index* II, pp.305-07, especially note 9.
186. *Ṛgveda*, IV.50.8; *tasmai Visah svayameva namante.*
187. *Ṛgveda* X.124.8.
188. *Ṛgveda* X. 173.6.
189. *Ath. Veda* IV.22.1.
190. *Ath. Veda* III.4.1.
191. *Ṛgveda*, X.173.1; *Ath. Veda*, IV.8.4; VI.87.1.
192. *Ṛgveda*, III.43.5; *Gopa janasya*; IV.4.3; *Payur Viś*; Viś paying tribute, *Ṛgveda* VII.6.5; X.173.6; *Ath. Veda*, XI.4.19.
193. Cattle was a very important factor in the economy; cattle was the recognized symbol of Viś, e.g. *Ṛgveda*, VII.35.18.
194. Various interpretations have been put on *panis, Vedic Index* I, pp.471-73. According to D.D. Kosambi they were non-Aryans, perhaps descendants of the Harappans—*The Culture and Civilization of Ancient India*, New Delhi, 1977, p.80. Professor G.C. Pande, after an exhaustive analysis of all Ṛgvedic passages referring to *Panis* concluded that they were traders and members of Viś—*Foundations of Indian Culture*, Vol.II, pp.190-8. The attitude of the Paṇis towards Brāhmaṇas and Brahmanical rites may represent the resentment of the rich and powerful members of Viś against the growing importance of the priestly class. The relationship between the Panis and priests also reflected the latters' disapproval of the practices of traders.
195. *Ṛgveda* IV.35.6; VI.32.1; IX.112.1.
196. *Atharvaveda* III.5.6.
197. *Atharvaveda* III.5.6-7.
198. *Ait. Br.* VII.29.3; *Tait. Sam.* VII.1.1.45.
199. *Ṛgveda* X.84.4; *Vedic Index* II, p.334.
200. R.S. Sharma, *Śūdras in Ancient India*, Varanasi 1958, Chapters II, III. The process of the emergence of Śūdras is not very clear. The theory of Aryan invasion explains the process as the outcome of the conquest of the dark-skinned, indigeneous pre-Aryan people by the fair-skinned victorious Aryans. The racial overtone of this interpretation has been vehmently contested. G.C. Pande, op.cit, pp.182-8. The *Arya-Anarya* difference was more cultural than racial; the expression arya in early Indian tradition signified what was good, desirable and exemplary rather than a superior race. The four cardinal truths in Buddhism, the path to salvation, bore the epithet *arya*. Buddhism surely cannot be accused of racial arrogance. Similarly, the expressions *anarya* (see for example *Bhagavat Gita* II.2.), was more a term of opprobium; one whose conduct was unbecoming of good people. In the *Aitareya Brāhmaṇa* VII.17. Sunahsepa accuses his father of Śūdralike conduct. Bifurcation of Viś between 'upper' and 'lower', leading to the rise of Śūdras is not a totally implausible theory. Anyway there seems little doubt that, among the four orders, the Śūdra *varṇa* was the last to grow.
201. The Vaiśyas owed their superior ritual status to the fact that they were members of the body-social from the very beginning of the crystallization of the concept of society. The Śūdras, it appears, were newcomers and could never completely shed the character of being outsiders.
202. *Tait. Sam.* VII.1.1.4.5.
203. *Ait. Br.* I.28; the Viś are associated especially with cattle in *Ṛgveda*. VIII.34.18.
204. *Jaiminiya Brāhmaṇa*, II.266.
205. *Tait. Br.* II.7.2.1-2. The Vaiśyas' association with Visvedevas symbolizes their being numerous and underlines their membership of the mass. Association with Pusan symbolizes food production.
206. *Vaj. Sam.* XXX, 6-21; *Tait. Br.* III.4.2-17.
207. *Jaim. Br.* II.266, Prof. R.S. Sharma argues that *Rathakāra, govikartana, takṣan, palagala* who have been counted among *ratnins* belonged to the *Śūdra varṇa*—Sharma, *Śūdras*, pp.49-50.
208. Prosperous Śūdra, *Mait. Sam.* IV.2.7.10; *bahu pasuh* Śūdra, *Pañcaviṁśa Brāhmaṇa* VII.1.11.
209. *Br. Up.* I.4.11-13; *cf. Kathaka Sam.* XXXVIII.1 where it is said that the sacrificer at the *rajasuya* buys longevity from a Śūdra by offering him a pot of beans.
210. *Śat. Br.* III.1.1.10; *Pancavimsa Br.* VI.1.11; *Mait. Sam.* VII.1.1-6.
211. *Mait. Sam.* IV.1.3; *Kath. Sam.* XXXI.2.
212. *Śat. Br.* II.1.4.2; IV.2.2.14. Even verbal contact with Śūdra was sometimes regarded ritually impure.
213. *Kath. Sam.* XI.10.
214. *Ait. Br.* VII.20.

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215. *Śat. Br.* V.3.5.11-14.
216. *Ch. Up.* VIII.14.1.
217. See above, especially notes 55-60.
218. Already in the creation hymns of the *Ṛgveda*, the Nāsādīya and Purusa *sūktas*, this attitude is found foreshadowed.

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CHAPTER XXI

Vedic Rituals

Kishore Nath Jha

The intellectual mass of India has been performing the religious rites like *yāga, homa, dāna, snāna, dhyāna* and *japa* from time immemorial, of which *yāga, homa* and *dāna* are accepted as prominent. Their prominence is clearly visualized in the ritual (*karmakāṇḍa*) portion of Veda. In the Vedas, religion in the form of sacrifice etc., has been prescribed as a duty for each and every householder as the means of worldly prosperity and achievement of heaven.

The *Mīmāṁsāśāstra* which aims at determining the meaning, through the interpretation of Vedic sentences and the explainable sentences of other *śāstras*, has cited the prescriptions of *yāga, homa* and *dāna* etc. as examples for the understanding of its own interpretative procedure. The reason behind this is the popularity of *yāga, homa,* etc., because of their being very much in vogue at that time.

Now-a-days, in the absence of the performance of *yāga, homa,* etc., even the learneds are not acquainted with them. Therefore, it is quite natural that interest in teaching and studying the *Mīmāṁsāśāstra* has slackened. However, its study requires, at the outset, a brief outline of *yāga, homa,* etc.

In a reply to the query: What is *yāga,* the *Mīmāṁsāśāstra* says: *yajati-codanā dravyadevatākriyam samudāye kṛtārthatvāt* (4.2.27), that is, the *homa* which is performed through the root *yaj* is called *yāga,* where the *dravya* meant for the deity is sacrificed through *prakṣepa.* In fact, there are three parts in a *yāga: uddeśya, dravya* and the abandonment of *dravya* through *prakṣepa,* i.e., giving up the ownership of one's possession. In *vidhivākyas,* there are references to *uddeśya* and *dravya* where the deities are described as *uddeśya* and the things which are abandoned are called *dravyas.* However, there is no reference to the place of *prakṣepa.* Therefore, a natural query arises, where exactly should the *dravya* be offered. The reply is given in the *Taittirīya-Brāhmaṇa* through the statement: *Āhavanīye juhoti* (10.10.10), which means, the desired *dravya* is to be offered in the *āhavanīya*-fire.

Although all these three parts are available in *homa* also, still there are some differences. In *yāga, devatā* and *dravya* are accepted as prominent and *prakṣepa* is accepted as subservient to them, whereas in *homa,* all the parts, namely, *dravya, devatā* and *prakṣepa,* share prominence equally and nothing is stated to be subservient. As a result, the *yāga* is nothing but a mental action in the form of verbal pronunciation, meant for the accomplishment of the ownership of the *dravyas* in favour of the desired deity for whom the substance is offered, cancelling the ownership of the *yajamāna,* and when the same *dravya* is offered in the *āhavanīya*-fire, it is called *homa.* The same thing is established in the

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Mīmāṁsāsūtra: tadukte śravanājjuhotirāsecanādhikaḥsyāt (4.2.28). Here the *prakṣepa* is intended by the term *āsecana* contextually, the term *adhika* in the *sūtra* denotes prominence (*pradhānatva*). This has been clearly stated in the statements: *Prakṣepāṅgakriyādvayavṛttijātir yāgatvaṁ kriyātrayavṛttijātiśca homatvam.* Here, from the term *kriyādvaya,* a part of *uddeśya* in the form of deity and a part of *tyāga* in the form of *dravya,* are intended and in the *kriyātraya* the part *prakṣepa* is added to those two.

The second difference is, in the term *yāga,* the *homa* is prescribed by the root *yaj* and in *homa* it is from the root *hu.* Expressions like *darśapūrṇamāsābhyāṁ yajeta svargakāmaḥ* and *agnihotraṁ juhuyāt* etc., are the two well-known examples.

The third difference is as follows: In the *yāga,* the *prakṣepa* is only made in fire, whereas in the *homa,* the *prakṣepa* is made in water, in addition to fire. For example, in the *avabhṛthahoma,* the *prakṣepa* is optionally prescribed for the water also.

The fourth difference is, in the *yāga,* the *yajamāna* puts the *sruvā* in the prescribed substance while uttering the hymn: *idamindrāya na mama,* offering the prescribed substance to fire with the *mantra: indrāya svāhā.* In this context, *yajamāna's* proprietary rights on the prescribed substance are relinquished and are transferred to another person, but the *sampradāna* does not become possible because of the deity being *mantramayī.* Because of the prominence of the *prakṣepa* in the *homa,* wherever something is prescribed for the deity, there is a *prakṣepa* of the substance where the owner's proprietary right is relinquished. Therefore, although *tyāga* exists in both the cases in the form of giving up the owner's proprietary right, still in one place it is *aparigraha* and in the other it is *prakṣepa.*

The *Kātyāyanaśrautasūtra* also accepts this particular difference between a *yāga* and a *homa.* This has been exactly stated in the *sūtra: dravyaṁ devatā tyāgaḥ* (1.2.2). Here an additional difference between *yāga* and *homa* is also pointed out: The *yāga* is that where the *homa* is performed in standing and *vaṣaṭkāra, yājyā* as well as *puronuvākyās*[1] are used, whereas *homa* is that where the pouring of oblations is performed in sitting position and where the *prakṣepa* is made through *svāhākara.* Let us consider the following *sūtras* best suited to our context:

> *Yajatijuhotīnāṁ ko viśeṣaḥ* (1.2.5).
> *Tiṣṭhadhoma-vaṣaṭkārapradānā yājyā-puro'nuvākyāvanto yajatayaḥ* (1.2.6)
> *Upaviṣṭahoma-svāhākarapradānā juhotayaḥ* (1.2.7).

In this connection, this is to be noticed that the deity who is accepted as *uddeśya* in *yāga* or *homa,* is the part of the *yāga,* no doubt because *yāga* etc., are not possible without it. But it is not capable of producing the result (*phala*) of the *yāga.* In other words, the state of producing the result does not exist in the deity whereas it exists in the *apūrva,* produced from *yāga* etc. Therefore, *apūrva* plays the role of mediator between the *yāga* and the *yajamāna.* This has been clearly stated in the *Śābarabhāṣya* that the deity is neither embodied nor does it consume the oblation offered in the sacrifice nor is it pleased or displeased to reward or curse the *yajamāna* (M.S. 9.1.6-9). *Apūrva* is produced from the *yāga* and is at the same time the producer of the heaven which is the result of the *yāga. Tajjanyatve sati tajjanyajanakatvam* has been mentioned in the *śāstras* as the definition of *dvāra.*

Three things are established from the above statement: (1) the deity is subordinate in the sacrifice, (2) *Apūrva* is accepted as prominent in the sacrifice and (3) the firm faith in *karma,* i.e. *yāga* etc.

The prominence of the deity is accepted in the *āgamas* where the *upāsaka* or the *sādhaka* gets the favour of the deity which is worshipped. However, in Vedic rites like sacrifice etc., the deity is merely a part of the sacrifice and not at all capable of giving sacrificial results. No gain or harm results from his pleasure or displeasure. Here the em

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phasis is on the similar direction of *karma, kartā* and *sādhana.* There should not be dissimilarity in any form of these three. Otherwise no result can be achieved. Contextually, Maharṣi Gautama, in his *Nyāyasūtra,* has described the dissimilarity of *karma, kartā* and *sādhana* as obstacles in producing the result of sacrifice.[2] This is the reason for which the Vedic concepts are accepted as *karmavāda,* whereas the *āgama* concepts are accepted as *anugrahavāda.*

In fact, no problem occurs in case of *dāna* where the abandonment (*tyāga*) is made in the form of relinquishing one's own proprietary right which has been accepted by the *pratigrahītā* by conferring his own proprietary right on it. There are three divisions in it: *dāna, utsarga* and *pratipatti.* That *dāna* is real where the names and the *gotras* of the *sampradāya* are mentioned through utterance and where the pre-acceptance and the post-acceptance of the of the *sampradānapuruṣa* exist. For example, the *kanyādāna*[3] and *śayyādāna* etc., in *śrāddha.*

The *dāna,* in the *saṁkalpa*-sentence of which the *sampradānapuruṣa* is not referred to, means the *dāna* which is offered by uttering the *saṁkalpa* sentence as: *Yathānāmagotrāya,* without mentioning any particular *nāma* or *gotra,* is called *utsarga.* For example, the *kraśarānna* (rice, dal) and *yava,* etc., are offered on the ceremonial occasions like *makarasaṁkrānti* and *meṣasaṁkrānti.* The things which are given up by the *yajamāna* without uttering any *mantra,* for the sake of his mental peace, one who is worried about utilizing a particular substance somewhere else or which was previously used for some other purpose, are called a *pratipatti.* For example, in case of *tadāga-utsarga* made through *caturagnividhāna,* a gold-adorned cow is entered in that *tadāga* and taken out after some time. Now a natural query arises about what to do with this cow. To meet this query it is stated that it should be given to a *sāmavedī* Brahmin. Such *dāna's,* however, will be known as *pratipatti.* The aforesaid view is well supported in the following verse:

Kanakālamkṛtām kṛtvā jale gām avtārayet
Sāmagaya ca sā deyā brāhmaṇāya viśāmpate

Similarly, in *pūjā* and *śrāddha* etc., the sacred thread, clothes and fruits etc., which are given to the Brahmin in addition to the *dāna* and *dakṣiṇā* which are given with the utterance of *dānavākya,* are also nothing but *pratipattis.* For this, sometimes, a statement like *pratipādyate* is uttered by the *yajamāna* meant for the *sampradānapuruṣa.* This must be borne in mind that *dakṣiṇā* is essential in both types of *dānas* except *pratipatti* and each and every sort of *yāga* and *homa.* This has been rightly stated that *hato yajñastvadakṣiṇaḥ* meaning a *yajña* without *dakṣiṇā* is lost. Here the term *yajña* refers to *homa* and *dāna* also by *upalakṣaṇa.* However, *dakṣiṇā* is not prescribed only for *pratipatti.*

A BRIEF OUTLINE OF PROMINENT *YĀGAS*

It is generally accepted that *yāgas* are of three sorts, namely, (1) *haviryāgasaṁsthā* (2) *somayāgasaṁsthā* and (3) *pākayāgasaṁsthā.* These three divisions of *yāga* are clearly stated in *Gautamadharmasūtra.* Mīmāṁsakas, however, hold a different opinion in this regard. They divide *yāgas* into (1) *Iṣṭi,* (2) *Paśu* and (3) *soma.* The *yāgas* where milk, curd etc. are used as *dravyas,* are called *iṣṭis.* Similarly, where the animals and the *soma*-juice are used as *dravyas,* are called *paśuyāgas* and *somayāgas* respectively.

Haviryāgasaṁsthā

According to *Gautamadharmasūtra,* seven *yāgas* are covered under the *haviryāgasaṁsthā.* They are as follows: *Agnyādhāna, agnihotra, darśapūrṇamāsa, Āgrayana, Cāturmāsya, nirūdhapaśubandha* and *sautrāmaṇi.*

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Agnyādhāna: Although no *yāga* can be performed without *Agnyādhāna* because the offering of oblation is to be made in fire only, still *darśapūrṇamāsa* has been regarded as *prakṛti* or *pradhānayāga.* This has been openly stated by Karkācārya and the *Śatapathabrāhmaṇa* starts with the procedure of *darśapūrṇamāsa. Agnyādhāna* is the collection and preservation of sacred fire where sacrificial oblation is offered. In the proper sense, the *Agnyādhāna* cannot be accepted as a sacrifice which is used as an essential instrument in the sacrifice.

In addition to these seven *haviryāgas,* some other *yāgas* like *dakṣayāga* and *traiyambaka* etc., are mentioned in the *Śatapathabrāhmaṇa.*

Moreover, *Agnyādhāna* is also important because of the fact that only after performing this *yāga,* the *yajamāna* couple is entitled to perform other *yāgas* like *haviryāga* and *somayāga* etc. The time of *Agnyādhāna* has been separately fixed for each and every class (*varṇa*) in the Vedas. The *brāhmaṇas* can go for it in spring season, whereas the *kṣatriyas* in summer and the *vaiśyas* in the rainy season.[4]

Fires which are installed are of four sorts, namely, (1) *gārhapatya,* (2) *āhavadnīya,* (3) *dakṣiṇāgni* and (4) *sabhyāgni.*

According to the *śrautasūtra: jātaputraḥ kṛṣṇakeśognin ādadhita,* a *yajamāna* is entitled for *agnyādhāna,* along with his wife after giving birth to a son in between 25 to 40 years of age. But he is expected to be black-haired till then. Here, this is also to be borne in mind that a *gṛhastha*-son whose father is alive, can be entitled for *agnyādhāna* only if his father possesses *āhitāgni* otherwise, he has to share the fault called *parivetṛtva* just as a younger brother is accused of marrying before his elder brother's marriage. In such cases (where the father does not possess *āhitāgni*) the son is entitled for *agnyādhāna* after his father's death and the funeral rites are called *sapiṇḍana.*

Agnihotra: Performing the *homa* in the morning and evening intended for fire, is called *agnihotra.* Many sacrificial substances like milk, curd, rice and barley etc., are prescribed for this *yāga.* Out of these substances milk is prominent and has been prescribed by *śāstra* for *nityahoma.* Rest of them are traditionally accepted for the *kāmyakarmas.* In this connection, some difference can be observed in *smṛtis.* In *Smārtollāsa,* the following ten *dravyas* are prescribed for *nityahoma:* oil, curd, milk, *soma,* wheat, cooked rice, ghee, rice, fruits and water.[5]

The prominent deity of this *yāga* starting from evening *homa,* is fire and the subordinate deity is Prajāpati who is the substitute of the accomplisher of the desired result i.e. the *sviṣṭakṛt.* The prominent deity of the morning *yāga* is the sun, whereas the subservient deity is Prajāpati. However, according to *Pūrvamīmāṁsā* 1.4.4, this particular *yāga* is called *agnihotra* because of the prominence of the Agni deity. This *agnihotra* is called *karma* through the maxim *tatprakhya.* This has been very much praised in *śāstras* and it is believed that by not performing it, one's life becomes useless and sinful.

Darśapūrṇamāsa-yāga: Darśapūrṇamāsa is the combination of two groups of six *yāgas* each, which are performed in *darśa* i.e., new moon day and *Pūrṇamāsi* i.e., full moon day respectively. First of all three *yāgas* are performed on full moon day. For example, (1) the *puroḍāśa-yāga,* consisting of eight *kapālas* and meant for Agni deity, (2) the *upāṁśuyāga* performed through *ghee* meant for Agni and *soma* and, (3) the *puroḍāśayāga* consisting of eleven *kapālas* also meant for Agni and *soma.* Consequently, in a similar fashion, following three *yāgas* are also performed on a new moon day: (1) the *yāga* which is performed through *dadhi* and wished for Indra, (2) the *yāga* which is performed through milk, again wished for Indra (the technical term used for these two *yāgas* is *sānnāyya*) and (3) the *puroḍāśa-yāga* intended for Agni. The mention of two *yāgas* instead of many can be justified by accepting the combination of three *yāgas,* each of which can be performed in a

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single day. Therefore, the instrumental dual number found in *darśapūrṇamāsābhyām svargakāmo yajeta* is used for *karma* instead of *karaṇa.*

Although the *darśapūrṇamāsayāgas* are performed at different times, since the efficiency of the result is pointed out to exist in the combination of the six *yāgas* mentioned above, they are accepted as one. As a result, nobody can achieve the concerned result of the *darśapūrṇamāsa* by performing either only *darśa* or only *pūrṇamāsa* (the combination of three *yāgas* each). Here a very interesting point is to be noted that though this sacrifice is named as *darśapūrṇamāsa* still the sacrifices performed in the *pūrṇamāsa* are to be undertaken first followed by *darśa* sacrifices performed on the new moon day.

According to *Āpastambaśrautasūtra,*[6] the *darśapūrṇamāsayāga* is the most prominent among all the sacrifices. Therefore, this is called *prakṛtiyāga* and the rest of the sacrifices are known as *vikṛtiyāgas.*[7] The sacrifice which is prescribed with all its *aṅgas,* is called *prakṛtiyāga,* and the sacrifices where the *aṅgas* of the *prakṛtiyāga* are accepted through *atideśa,* are called *vikṛtiyāga.*

In this particular *yāga* the presence of four *ṛtvik*-priests is essential along with the *yajamāna*-couple. They are: *adhvaryu, brahmā hotā* and *āgnīdhra.*[8] Adhvaryu is prominent amongst them, who performs his duty from beginning to end by sitting to the east of the sacrifice. Brahmā holds the second position, who inspects the whole sacrifice from beginning to end as he is well-acquainted with the sacrifice. He sits in the southern side of the sacrifice and keeps himself busy in deciding what is to be done and what is not be done. *Hotā* who sits in the western side, recites the hymns like *sāmidheni* etc., whereas *Āgnīdhra* sits in the northern side of the sacrifice and says *astu* 'let it be so' on each and every action performed by the *adhvaryu.* In each and every sacrifice, the brahmins are allowed to be *ṛtvik*-priests. The *dakṣiṇā* prescribed for them, however, differs on the basis of their nature of work. Thus, the *adhvaryu* receives the maximum whereas the *āgnīdhra* is paid with the minimum of the *dakṣiṇā* prescribed.

There are a good number of small rituals in *darśapūrṇmāsa* sacrifice. The most prominents of those rituals are presented here: (*a*) *Agnyuddharaṇa,* where *āhavanīya* and *dakṣināgni* are separated from *gārhapatya*-fire, (*b*) *agnyanvādhāna,* in which six *samidhs* are offered in the *gārhapatya, āhavanīya* and *dakṣiṇāgni* with the *mantra 'māmagnevarca',* etc., (*c*) *brahmavaraṇa,* where the *yajamāna* appoints a person as a supervisor who is well versed in the injunctions of the sacrifices by presenting him the *paridhānīya* and *alaṁkaraṇa,* etc., who accomplishes his duty by sitting in the southern side of the sacrifice, (*d*) *praṇītāpraṇayana,* where a water container is placed near the sacrifice to collect water required for the sacrifice and *dakṣiṇā* is given for the satisfaction of *Brahmā* after the completion of the sacrifice, (*e*) *paristaraṇa,* in which the sacrificial fire is covered with *kāśa* from all sides, (*f*) *pātrasādana,* in which all the sacrificial containers are placed before the sacrifice, (*g*) *pariṣkārasaṁskāra,* performed for the purification of the sacrificial substances e.g., the instruments like *agnihotrahavanī* and *śūrpa,* etc., are to be heated in the fire before use, (*h*) *śakaṭa* or *iḍāpātrī,* through which the *haviṣ* is received in the *agnihotrahavaṇi,* (*i*) *pavitrakaraṇa* or *pavitranirmāṇa,* in which the middle leaves of the *kuśa*-grass are taken out by leaving the upper portion as long as the *prādeśa,* the span of thumb and forefinger with two leaves, which is called *pavitra*[9] and common to all sacrifices, (*j*) *pātrahaviḥ prokṣaṇa,* 'the purification of the *haviṣ* kept in the container', (*k*) *peṣaṇa,* 'grinding of sacrificial substances', (*l*) *kapālopadhāna,* through which the *kapālas*[10] meant for the sacrifice are kept serially as prescribed, (*m*) *upasarjani,* hot water used for mixing the grinding substance, (*n*) *haviṣ,* 'sacrificial substance' (these two things:*upasarjani* and *haviṣ* are kept on fire before the use), (*o*) *vedikaraṇa,* 'the construction of the altar', (*p*) *stambayajurharaṇa,* cutting of the *kuśas* by chanting Yajurvedic-mantras, (*q*) *sammārga,* the cleaning of the sacrificial instruments like *sruvā,*[11] *juhū,*[12] *upabhṛt*[13] and *dhruva,*[14] etc.,

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with water, (*r*) *patnisannahana,* making a rope of *muñja* for girdling the wife, (*s*) the *prokṣaṇa* of *idhma,*[15] *barhiṣa*[16] and *vedi,* (*t*) *prastaragrahaṇa,* the collection of *prastara,* i.e. a handful of many *kuśas,* (*u*) *paridhiparidhāna,* the *vedistaraṇa* and the collection of arm-long *palāśa*-wood.

In addition to that, there are certain minor rites and technical terms used in connection with this sacrifice, which are briefly explained in the following paragraph: *vidhṛtisthāpana,* i.e., the placing of *idhmas* and the collection of *prastara,* the placement of *juhū,* etc., and the reciting of *sāmidheni*[17] *-mantras, agnisammārjana* and *āghāra,*[18] *hotṛvaraṇa*[19] and *pañcaprayājavidhāna*[20] the accomplishment of *ājyabhagā-homa* where *agni* and *soma* are accepted as deities.

The *pradhānayāga* is performed by referring to the concerned deity who is prescribed for the production of result and *sviṣṭakṛt-yāga* is also performed in support of the *pradhānayāga.* The etymological meaning of *sviṣṭakṛt* is: *Su-suṣṭhu iṣṭamabhipretam karotiti-sviṣṭakṛt.* 'Sviṣṭakṛt is that where the desired object is well achieved.' Then the share of *Brahmā* is given which is technically known as *prāśitrāvadāna.*[21] The prescription of *Iḍāvadāna* and *bhāgaprāśana,* etc., are known as *anvāhāryadakṣiṇā,*[22] 'the means of removing known and unknown faults in the form of feeding rice to the *ṛtvik'.* These things have been clearly stated in the *Sāyaṇabhāṣya* of *Śatapathabrāhmaṇa.*[23] After that there is a reference to perform three *anuyājas* which are generally performed after the *pradhānayāga,* where *Hotā* recites the *yājyāmantras.* Then *vyūhana,* i.e., *juhū* is removed to eastern side, whereas *upabhṛt* is placed in the western side and the *sūktavāk* as well as *śaṁyuvāk* (the eulogical hymn of *śaṁyu,* the son of deity Bṛhaspati) are recited. This rite is followed by *patnīsaṁyāja* where four related *yāgas* are performed which are intended for *patnī* as deity. Finally, *dakṣiṇāgnihoma, barhiahoma, praṇitāvimoka* (*tyāga*) and *viṣṇukrama* are performed. In this series of rituals, the *yajamāna* undertakes *vratavisarga* and *brāhmaṇatarpaṇa,* i.e., *brahmabhoja.*

This sacrifice ought to be performed life long. If this is not possible then it may be performed for 30 years at least.

Cāturmāsyayāga: Cāturmāsyayāga takes one year for its completion. Each of the four sacrifices is accomplished annually once in four months. Therefore, this sacrifice is called *cāturmāsya.* The sacrifices like *vaiśvadeva, varuṇapraghāsa, śākamedha* and *śunāsīrīya* are serially performed with a gap of four months in this particular *yāga. Vaiśvadeva* is performed in *phālgunīpūrṇimā, varuṇapraghāsa* in *Āṣāḍhīpūrṇimā, śākamedha* in *Kārtikīpūrṇimā* and *śunāsīrīya* is performed on *phālgunaśuklapratipat.*

The *parvan* which is perceived by all the deities, is named as *vaiśvadeva.*[24] The sacrifice which is performed with a particular *haviṣ* containing the *bhakṣya* specifically meant for *varuṇa* deity is called *varuṇa-praghāsa.*[25] In other words, the rites by which the noose (*pāśa*) of *varuṇa* is loosened is known as *varuṇapraghasa.*[26] A particular *haviṣ* by which the deities are ceased to prosper is called *śākamedha.*[27] The sacrifice which is intended for *vāyu* and *sūrya* is known as *śunāsīrīya.*[28]

Vaiśvadevayāga: Vaiśvadevayāga is performed with eight sorts of *haviṣ.* They are as follows: (1) the *puroḍāśa* made in eight *kapālas* for the sake of Agni, (2) the *caru* made for *soma* deity, (3) the *caru* meant for *sarasvatī,* (4) the *piṣṭacaru* meant for *pūṣā* deity, (5-6) the *puroḍāśa* prepared in seven *kapālas* meant for *Marut* and *svatavadguṇaviśiṣṭamarut,* (7) the *āmikṣā* meant for *viśvadeva* and (8) the *haviṣ* of the *kapāla* meant for *dyāvāpṛthivī.* This *yāga* is performed in a similar way as *darśapūrṇamāsa* is performed. Therefore, this has not been prescribed separately. The only deviation is that in *vaiśvedeva,* nine *prayājas* and nine *anuyājas*[29] are prescribed and the *yāga* is performed through *vājina* intended for *vājina* deity and three *samiṣṭayajus.*[30] The solid part separated from the milk by souring is *āmikṣā* and the remaining watery portion is

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known as *vājina.* Just like *darśapūrṇamāsa* here also four *ṛtviks*: *adhvaryu, Brahmā, hotā* and *āgnīdhra* are mentioned.[31] The other sacrifices are also performed in a similar fashion.

Varuṇapraghāsa: Four different *haviṣ* are prescribed for *varuṇapraghāsa* in addition to the first five *haviṣ* mentioned in case of *vaiśvadeva* sacrifice. The four additional *haviṣ* are: *aindrāgnadvādaśakapāla, vāruṇī-āmikṣā, mārutī-āmikṣā* and one *kapāla* meant for *Brahmā* deity.

This *yāga* consists of two altars: *dakṣiṇavedi* and *uttaravedi.* Four *ṛtviks* are also prescribed for this *yāga.* However, an additional member is required here, namely *pratiprasthātā* who performs *yāga* in the *dakṣiṇavedi.* In *uttaravedi,* the *adhvaryu* makes use of eight kinds of *haviṣ* like *Agneya* etc., whereas in *dakṣiṇavedi* the *pratiprasthātā* offers *mārutī-āmikṣā.*

An important point is to be noted in this context that in *Kātyāyanaśrautasūtra* it is clearly stated that *praṇītāpraṇayana, patnīsannahana, agnimanthana, āśruta, pratyāśruta, paiṣa, yajamānavācana, hotṛṣadana, hotṛvaraṇa, prāśitra, aṅguliparvañjana, avāntareḍāgamana, aparāgni* and *avabhṛtha* are not to be performed by *pratiprasthātā.* The construction of two *vedis* and *agnipraṇayana* are two more rites performed in this *yāga* in comparison to other sacrifices. Similarly, making *karambhapātra*[32] and performing its *homa* are two other additional rites to be specifically performed in this sacrifice. The *adhvaryu* makes four *karambhapātras* out of barley powder before one day, i.e., on *caturdaśī.* On *pūrṇimā,* the *adhvaryu* makes *meṣa* out of barley powder and *pratiprasthātā* makes *meṣī.* The wife of the *yajamāna* takes them on her head by keeping on a *śūrpa* and offers them in the *dakṣiṇāgni.* In *uttaravedi, adhvaryu* performs *meṣahoma* and in *dakṣiṇavedi, pratiprasthātā* performs *meṣīhoma.*

This particular *yāga* has the following peculiarity. The *yajamāna's* wife who is carrying the *karambhapātra* for *homa,* is asked by *pratiprasthātā* whether she has any paramour[33] other than the husband. If she has any extra martial affair then she has to tell his name. The real intention behind this question is, even a chaste lady (having no extra marital affair) might have some secret weakness for somebody—other than her husband. In that case, she also has to speak the name of such person. However, it does not necessarily mean that the *yajamāna's* wife should have some extra marital affair. The only intention is, if she has some, she has to speak it out otherwise not.

In *avabhṛtha,* however, the peculiarity is as follows: the *yajamāna's* wife removes the sacrificial substance *'āmikṣā'* meant for *varuṇadevatā* from the sacrificial altar and takes bath in a holy place after offering six or ten oblations as per the rule. The *dakṣiṇā* prescribed for this sacrifice is either cows (six or twelve) or horses.

Śākamedha: The *śākamedha* sacrifice is performed on *kārtikapūrṇimā.* It consists of many small sacrifices. On the previous day, i.e., on *caturdaśī, Anīkavatī* is performed in the morning, *sāntapana* at noon and the sacrifice *gṛhamedhīya* is performed in the evening. The deity of *Anīkavatī* is Agni, whereas the deity of other two is stated as *marut.* The sacrificial substance prescribed for these three *yāgas* are eight *kapālas, carudravya* and milk-made *caru* respectively. The *dakṣiṇā* prescribed for *Anīkavatī* and *sāntapana* is *anvāhārya,* i.e., monthly food and for *gṛhamedhīya,* a *ṛṣabha,* i.e. a superior bull. The remaining sacrificial substance of *gṛhamedhīyayāga* (i.e., *Pāyasacaru*) can be eaten by any family member of *yajamāna* who has undergone *upanayanasaṁskāra,* and the other *brāhmaṇas. Prayāja* and *anuyājas* are not performed in the above said three sacrifices. On *caturdaśī,* the *agnihotra* is performed through *yavāgū* (the barley powder mixed with hot water) in the morning and evening. In the morning of *pūrṇamāsī,* however, the *homas* like *uddharaṇa,* etc., are performed.

Five *yāgas* are performed in *pūrṇamāsī.* They are: *Krīdanīyayāga, aditiyāga, mahāhaviryāga, pitṛyāga* and *tryambakayāga.* The deity of *Krīdanīya* is *marut* whereas *puroḍāśa* and *anvāhārya* are *dravya* and *dakṣiṇā* respectively.

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Aditiyāga is performed through the oblation *caru* and wished for the deity *Aditi*. Here also the *dakṣiṇā* is no other than *anvāhārya*.

Mahāhaviryāga is performed in *uttaravedi*. Here also eight *haviṣ* are taken into use including the first five *haviṣ* of *vaiśvadeva* (vide *vaiśvadeva*). The additional three *haviṣ* are: *aindrāgnadvādaśakapāla, mahendracaru* and *ekakapāla* offered in favour of the deity *viśvakarmā*.

Pitṛyajña is performed in *dakṣiṇavedi*. *Dakṣiṇavedi* is constructed for this *yāga* and *dakṣiṇāgni* is inflamed highly and installed in it. All sorts of *homa* are performed in this fire. Here the deities are: *Somavān pitara, pitarayutasoma, barhiṣadapitara* and *agniṣvātta pitara*.

The *homa* is performed with the following oblations: *Puroḍāśa* made in six *kapālas*, the fried barley and *mantha* made of *saktu* mixed with the milk of a cow whose calf is dead. Two *anuyājas*, four *prayājas* are also performed in this sacrifice. Here also the *dakṣiṇā* is prescribed as *anvāhārya*, i.e. monthly fooding.

Tryambaka (*Rudra*) is the deity of *tryambakeṣṭi* where *puroḍāśa* made in *ekakapāla* is offered as oblation. Only one *ṛtvik* (i.e., *adhvaryu*) is prescribed for this sacrifice who performs his duty by sitting with his face towards north. This sacrifice is mainly performed without chanting any *mantra*. *Ṛṣabha* (the best bull) is prescribed as its *dakṣiṇā*. Here the fire is brought to *catuṣpatha* by making *ulmuka*, a fire-brand of *dakṣiṇāgni*, where the *ulmukāgni* is installed after *bhūsaṁskāra*. The *homa* is performed in this fire with the *puroḍāśa* which is divided into four equal parts by a *juhū* made of *palāśa*-leaves. Three fourth of the *puroḍāśa* is offered into the *homa* and one fourth is thrown into the holes of the rats. *Yajamāna* with his family makes *pradakṣiṇā* of this fire. The rest of the *puroḍāśa* which was left aside is thrown above with two hands and it is lifted with hands when it falls down to be divided into two equal parts. The two parts are placed in the two *rope-made containers* bound to both the sides of a bamboo stick and hung in the northern direction, either from a tree or trunk of a tree or a bamboo or an ant hill.

Śunāsīrīyayāga: The *śunāsīrīyayāga* is performed just as the *pūrṇamāsayāga*. Here also some more oblations are prescribed in addition to the first five *haviṣ* of the *vaiśvadeva* sacrifice. For instance, *dvādaśakapālas* for *śunāsīras*, milk or wheat for *vāyu* and *ekakapālahaviṣ* for the deity *sūrya*. The *dakṣiṇā* prescribed for this sacrifice is either a plough yoked with six oxen (*ṣaḍgavo halaḥ*) or two big bulls. However, the *dakṣiṇā* for *saurayāga* is either a white horse or a cow.

Two alternatives and three divisions are described in the *śāstras* with reference to this particular *cāturmāsya*-sacrifice. Following are the two alternatives: (*a*) *Yāvajjīvapakṣa*, i.e., performing the sacrifice for life long and (*b*) *Utsargapakṣa*, i.e., performing only once in life. In the *utsargapakṣa*, after performing *śunāsīrīyayāga* one has to perform *agniṣṭoma* in the next *pūrṇamāsī*, whereas in *yāvajjīvapakṣa* one has to perform *vaiśvadeva* in a similar way.

The three divisions of this *yāga* are: *aiṣṭika, paśuka* and *saumika*. The above mentioned procedure of *śunāsīrīya* is as it is applicable to *aiṣṭika-cāturmāsya*. However, if it is performed with *paśudravya* then it will be called *paśuka* where eleven *prayājas* and eleven *anuyājas* are performed. In the first *parvan*, *vaiśvadeva* is accepted as *paśudravya*, whereas in the second it is *varuṇa*, in the third it is *mahendra* and in the fourth it is none other than the *śunāsīrīya*. The animals are prescribed as *dravyas* with reference to the deities associated with four *cāturmāsya* sacrifices. Therefore, the above mentioned name (*śunāsīrīya*) should be accepted as *anvarthaka*, i.e., etymological. Here again three alternatives are shown in the system itself. They are: (*a*) the *paśuhoma* along with the sacrificial substance through similar *tantra*, (*b*) performing *homa* with sacrificial substance after the *paśuhoma* through separate *tantra* and (*c*) the *paśuhoma* at the end of *yāga* through separate *tantra*.

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In the *saumika, agniṣṭoma* is to be performed in place of *vaiśvadeva, agniṣṭoma* or *ukthya* in place of *varuṇapraghāsa* on the first day and only *ukthya* on the second day. *Śākamedha* is substituted by *agniṣṭoma* or *ṣoḍaśīyāga* on the first day, by *ukthyayāga* on the second day and by *atirātra* on the third day. *Śunāsīrīyayāga* is substituted by *jyotiṣṭoma.* However, *avabhṛtha* is performed in each and every sacrifice.

The division of this *yāga* is also made in a different way. They are: *sāṁvatsarika, pañcāhika* and *ekāhika. Sāṁvatsarika* is to be completed in one year whereas *pañcāhika* and *ekāhika* are to be completed in five days and one day respectively. The report of the *sāṁvatsarika* is already given earlier. In *pañcāhika* and *ekāhika,* the *devatā* and the *dravya* are the same as that of *sāṁvatsarika.* But the *aṅgayāgas* are mostly performed through *tantra*-system. Therefore, some rites are repeated. More knowledge of this sacrifice can be possible only by observing the system of this sacrifice.

Nirūḍhapaśubandhayāga: Nirūḍhapaśubandhayāga is to be performed once in every year in the rainy season. Optionally it can also be performed twice in a year, i.e. once in *uttarāyaṇa* and once in *dakṣiṇāyana.* Here the deity is accepted as either the combination of Indra and Agni, or Sūrya, or prajāpati. Some specific limbs of goat are accepted as *dravyas.* For example, *vapā, hṛdaya, jihvā, vakṣa,* the first *nadaka* of the left arm, *Parśvāyugala, yakṛt, vṛkka,* the middle part of anus and the right thigh. These are generally offered with a *juhū.* Therefore, they are called *jauhava.* The left arm, left thigh and anus are called *aupabhṛta,* because they are offered with *upabhṛt.* Six priests are prescribed for this *yāga.* They are: *adhvaryu, Brahmā, hotā, āgnīdhra, pratiprasthātā* and *Maitrāvaruṇa.*

A *yūpa* is made from khadira or palāśa tree for this sacrifice to bind the animals which is generally made smooth and designed with eight specific designs. A third person other than these priests makes *paśusaṁjñapana* for the accomplishment of *dravyas.* The killing of the animal by stopping its breath by muffling its face without using any weapon is called *Paśusaṁjñapana.* Most probably Kālīdāsa's statement: *Paśumāraṇa Karmadāruṇaḥ anukampāmṛduko Pi śrotriyaḥ* also refers to this procedure. After *paśusaṁjñapana,* the *vapā* is removed first followed by the removal of other *aṅgas.*

After that, the *sviṣṭakṛtyāga* which is generally performed after the main sacrifice and the *anuyāja* etc. are performed. Here since eleven *prayājas* are prescribed, the number of *anuyājas* should also be eleven. If the *yāgas* performed with *dhānya* 'grains' etc. then *prayājas* are performed after the offering of *haviṣ* and then only the *pradhānayāga* is accomplished. But if the *yāgas* are performed with the animals then ten *prayājas* are performed in the presence of the animal near the *yūpa* and the remaining one *prayāja* is accomplished after the animal is victimised. The *dakṣiṇā* in this sacrifice is stated to be a cow or a *dhenu* 'a cow begetting her first issue'.

According to *śruti,* this is the *prakṛti-yāga* of *agniṣṭomīyapaśuyāga* which is the part of *jyotiṣṭoma.* But the *sūtrakāra* has incorporated it under the seven *haviryāgas.*

Āgrayaṇeṣṭi: The sacrifice which is performed at the time of new crops, is called *Āgrayaṇeṣṭi.*[34] This is performed twice in a year. The time of this sacrifice is fixed as autumn and spring season. *Puroḍāśa* and *caru* are prescribed as sacrificial substances. Indra and Agni are offered with *puroḍāśa,* whereas *dyava* and *pṛthivi* are offered with *caru.* The *caru* of barley is mixed with milk. New paddy and barley are accepted as the main oblation for the *homa.* After proper repairing a broken chariot is given as *dakṣiṇā* in this sacrifice. This *yāga* is accepted as obligatory (*nitya*). The *āhitāgni-yajamāna* is allowed to take *navānna* only after the accomplishment of this sacrifice. Even one who is not an *Āhitāgni,* has to perform this *iṣṭi,* says *Gṛhyasūtra.* Here an interesting point is to be noted that *vrīhi* and *yavānna* both are alternatively prescribed as the sacrificial substance for this sacrifice. In other words, this *yāga* is performed with *vrīhi* till the harvesting of *yava* and again performed with *yava* till the harvesting of *vrīhi.*

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Sautrāmaṇīyāga: *Sutrāmā* is an epithet of Indra. Therefore, a *yāga* which is performed through *Paśudravya* and meant for Indra is called *Sautrāmaṇī*. This is performed in two ways, i.e., as an independent one and as a subsidiary to any *yāga*. Performing *Sautrāmaṇī* independently for the achievement of *nitya*, *kāmya* and *naimittika*, comes under the first type whereas performing this sacrifice as a subsidiary to another *yāga* which is undertaken, comes under the second type.

When this particular sacrifice is performed not for the sake of *phala* is called *nitya*, when it is performed for the sake of prosperity it is known as *kāmya* and when it is performed because of some *nimitta* like *soma* etc., becomes *naimittika*.

Only a brahmin is allowed to perform this sacrifice independently. However, as a subsidiary it can be performed by any *dvija* 'one who has undergone the *saṁskāras*'.

The goat, sheep and healthy bull can be utilised in this sacrifice. In fact, the collection of these animals is called *sautrāmaṇī*. The *Aśvins* (twin), Sarasvatī and Indra are the deities of this sacrifice. This sacrifice has six priests, namely, *adhvaryu*, *Brahmā*, *hotā*, *āgnīdhra*, *pratiprasthātā* and *maitravāruṇa*. Three of these priests take milk and the rest take *surā*. Therefore, the procedure of making *surā* is also described here. Since drinking wine is a taboo in *Kaliyuga*, all of the priests take milk only. Therefore, in *Āpastambaśrautasūtra*, the milk is optionally prescribed in place of wine.[35] As a second alternative, the priests accomplish the sacrifice by taking the milk in a *tāmra* pot which resembles the *surā*.

Here, this is also to be borne in mind that unlike other sacrifices, in *paśupuroḍāśayāga* which is a subsidiary to this sacrifice, the lord of animals is not accepted as the deity. On the contrary, Indra, Varuṇa and Savitā, etc., are stated as the deity of this sacrifice.

The name of another *yāga* is stated as *caraṇa-sautrāmaṇī* which is subservient to *rājasūyayāga*. In some other schools, a *yāga* called *Kokilasautrāmaṇī* is performed in four days with five animals. This is a brief outline of seven *yāgas* of *haviryāgasaṁsthā*. However, for details one has to consult the concerned texts.

Pākayajñasaṁsthā

1. Seven *yāgas* are mentioned under *pākayajñasaṁsthā* in the *Gautamadharmasūtra*. They are: *Aupāsanahoma*, *Vaiśvadevakarma*, *Pārvaṇa*, *Aṣṭakā*, *Māsikaśrāddha*, *Śrāvaṇakarma* and *Śūlagava*.

The *homa*, which is performed in the evening and morning with curd and rice by hands, is called *aupāsanahoma*. Agni in the evening and Sūrya in the morning are the eminent deities of this *homa*, whereas *Prajāpati* is the subservient deity for both the periods who is accepted as the substitute of the *sviṣṭakṛt*. This *homa* starts in the evening and ends in the morning. Therefore, the statement *Sāyam prātaḥ homam kariṣye* is uttered in the *saṁkalpa*. Both the *homas* combined together are accepted as one *homa*. Therefore, the concerned result is achieved only after performing both the *homas*. Quite obviously, the *Kartā* and the *dravya* will be the same for both the *homas*. This *homa* is prescribed life long provided that the wife is alive.

2. *Vaiśvadevakarma* comes next in the series. As per the etymology,[36] the *yāgas* for all deities are accomplished with this *homa*. In *smṛtis*, this is otherwise named as *pañcamahāyajña* consisting of *devayajña*, *bhūtayajña*, *pitṛyajña*, *manuṣyayajña* and *brahmayajña*. This is also to be performed invariably by any *gṛhastha*.

3. *Pārvaṇa* is the third type in this series where *piṇḍa* is offered on each *amāvasyā* meant for six generations, viz., *pitā*, *pitāmaha*, *prapitāmaha*, *mātāmaha*, *pramātāmaha* and *vṛddhapramātāmaha*. The performance of this *yāga* is also obligatory.

4. *Aṣṭakāśrāddha* is the fourth division of *pākayajña* and performed in the *kṛṣṇapakṣa-aṣṭamīs* of four months of *hemanta* and *śiśira* seasons (*Āgrahāyaṇa*, *pauṣa*, *māgha* and

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phālguna) with *apūpa*, beef and vegetable in the favour of Indra, Viśvedeva, Prajāpati and *Pitars*.

5. The term *māsikaśrāddha* is self-explanatory. This *yāga* or *śrāddha* is performed every month and meant for the father. The term *māsikaśrāddha* also denotes the same thing.

6. *Śrāvaṇa-Karma* is the sixth category in this series which is performed everyday between *śrāvaṇī-pūrṇimā* to *Kārtikī-pūrṇimā*. This *balikarma* is accomplished in favour of snakes.

7. *Śūlagava* is the final *yāga* in this series which is performed with beef and finds a mention in the *Pāraskara-gṛhyasūtra*.[37]

Since *gohatyā* is prohibited in *Kaliyuga* this *yāga* is not being performed today. In some other *śākhās* this *yāga* is substituted by *sthālīpākayāga*.

Somasaṁsthā

Because of being performed with *soma*-juice, this *yāga* is popularly known as *Somayāga* which has seven divisions, namely, *agniṣṭoma, atyagniṣṭoma, ukthya, ṣoḍaśī, vājapeya, atirātra* and *āptoryāma*. Out of these seven, *agniṣṭoma* is prominent which is otherwise known as *jyotiṣṭoma*.

In the course of time, the *Agniṣṭoma* itself is divided into two, namely, *ekāha* and *ahīna*. The *yāga* which is performed in a single day is called *ekāha* while the *ahīna* is performed between two to twelve days. In fact, *dvādaśāhasatra*[38] is related to *ahīna*, where the number of *yajamānas* is stated to be many (mostly seventeen). Sometimes, this *yāga* is continued for more than twelve days. The prominent *yāgas* like *gavāmayana, rājasūya, sautrāmaṇi* and *aśvamedha* etc. along with the small *yāgas* like *vasordhārā, rāṣṭrabhṛt, vājaprasavīya* and *payovrata* etc. are performed under this category. In most of the *somayāgas*, the killing of animal (i.e. goat) is prescribed. Therefore the ancient seers have incorporated *paśuyāgas* under the *somayāgas*. But the later scholars have made three categories out of it, namely *iṣṭi, paśu* and *soma* in *śrautapadārthanirvacana*. The difference between a *somayāga* and a *paśuyāga* is not available in *śrautasūtra* and *śatapathabrāhmaṇa*.

Two alternatives are prescribed with reference to the performance of *somasaṁsthā*. In the first alternative, *yajamāna* who is interested in performing *somayāga* should perform *darśapūrṇamāsa* etc. after the performance of *somayāga* by installing fire in the spring season. In the second alternative, however, the *yajamāna* is entitled to perform *somayāga* only after performing the *darśapūrṇamāsa* etc.[39]

Soma juice is the sacrificial substance of this *yāga*. *Soma* is the name of a creeper,[40] the juice of which is squeezed after purchasing it and the oblation is offered through this juice. The details of this sacrifice is stated in the *Brāhmaṇagranthas*.

1. *Agniṣṭoma*: Although it is said that the *agniṣṭoma*-sacrifice is accomplished in a single day it still requires five days to be performed, with all its subsidiary sacrifices. This can be assumed by observing the concerned systems.

There are sixteen *ṛtviks* in this sacrifice and they are classified into four *gaṇas*: *adhvaryugaṇa, Brahmagaṇa, hotṛgaṇa* and *udgātṛgaṇa*. Each *gaṇa* has four *ṛtviks*, the details of which can be observed in the following Table:

Adhvaryugaṇa	*Brahmagaṇa*	*Hotṛgaṇa*	*Udgātṛgaṇa*
Adhvaryu	*Brahmā*	*Hotā*	*Udgātā*
Pratiprasthātā	*Brāhmaṇacchamśī*	*Maitrāvaruṇa*	*Prastotā*
Neṣṭā	*āgnīdhra*	*(Praśāstā)*	*Pratihartā*
Unnetā	*potā*	*acchāvāk grāvastut*	*Subrahmaṇya*

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The place of these *ṛtviks* has been fixed in the *śāstras*. *Pratiprasthātā* is inferior to *adhvaryu*. Therefore, dissimilarity or rather gradation is observed in their *dakṣiṇās*. For instance, first of all the cows which are prescribed as *dakṣiṇā*, are classified into four groups. The *adhikāra* of each group of the *gaṇas* is mentioned above. The *ṛtvik* of each *gaṇa* shares the *dakṣiṇā* as per his number in the serial order. As a result, in *adhvaryugaṇa* for instance, *pratiprasthātā* gets lesser than *adhvaryu* and *neṣṭā* gets lesser than *pratiprasthātā* and *unnetā* gets the least i.e., lesser than *neṣṭā*. This procedure of gradation in *dakṣiṇā* is applicable for each and every *gaṇa*.

Somayāga is related to *vedatrayi*, i.e., *ṚK* etc. This view is supported by the statement: *yajñaṁ vyākhyāsyāmi sa tribhir vedaiḥ*, appearing in the *Āpastambaśrautasūtra*. *Agnihotra* is related to one *Veda*, i.e. *Yajurveda* and *darśapūrṇamāsa* etc. are related to two *Vedas*, i.e., *Ṛgveda* and *Yajurveda*. In a similar way, some *yāgas* are accomplished and performed as per the injunctions stated in one *Veda* and some others as per the two *Vedas* or three *Vedas*. The *ṛtvik* of *somayāga* is expected to be a knower of three *Vedas*. Similarly, the *ṛtviks* of *adhvaryugaṇa* are *yajurvedins*. The *ṛtviks* of *hotṛgaṇa* perform *bahṛc*, whereas the *ṛtviks* of *udgātṛgaṇa* perform the rites of *Sāmaveda*. The *ṛtviks* of *Brahmagaṇa* supervise the duties of other *ṛtviks* since he is the knower of three *Vedas*. Thus, each and every *ṛtvik* of all *gaṇas* has some specific purpose to serve, so far as the *yāgas* are concerned.

Agniṣṭoma is named so because it comes under *agiṣṭomasaṁsthā*. *Agniṣṭoma* is the name of the *sāman*. The *mantras* like: *Yajña yajñavo agnaye*, etc., are musical, therefore, they are called *sāmans*. Since these *mantras* are utilised in *agniṣṭoma*, they also can be called *sāman*. The term *saṁsthā* denotes *samāpti* 'completion'. Since this is used as final *sāman*, it is called *agniṣṭomasaṁsthā*. In *Vedas*, the *yāgas* are named according to the names of the *sāman* with which the *somayāga* is completed. For example, *ukthya* and *ṣoḍaśī*, etc. The *yāga* which is completed with *agniṣṭomasāman* is called *agniṣṭoma*.

Agniṣṭoma is the first *yāga* of *jyotiṣṭoma* which is etymologically a self-explanatory technical term. The *ṣṭomas* 'eulogies' like *trivṛt*, *pañcadaśa*, *saptadaśa* and *ekaviṁśas* are called *jyotiṣ*. The *yāgas* which has *jyotiṣ* as its eulogy, is called *jyotiṣṭoma*.

The *ṣṭoma* which has three parts is called *trivṛt* consisting of nine *ṛcas*, viz., three *sūktas* containing three *ṛcās* each.

The eulogy *trivṛtṣṭoma* is accomplished in three phases by reciting three *ṛcās* in one group. A *tṛc* consists of three *ṛcās*. According to the *Brāhmaṇagranthas*, the combination of three *tṛcs* becomes *pañcadaśa*, i.e., 15 *ṣṭomas* by repetition. In the first *tṛc*, the first *ṛcā* is repeated thrice, in the second the middle *ṛcā* is repeated thrice whereas in the third the last *ṛcā* is repeated thrice.[41] The other two *ṛcās* are repeated once in each case. The following Table may clearly present the position.

Tṛc	*ṛcā*(1)	*ṛcā*(2)	*ṛcā*(3)	
1.	3	1	1	= 5
2.	1	3	1	= 5
3.	1	1	3	= 5
				15

Similarly, 'Seventeen *Ṣṭomas*' and 'twentyone *ṣṭomas*' are recited as per the instructions given in the *Brāhmaṇagranthas*.

In all four *saṁsthās* are incorporated under this sacrifice. They are: *agniṣṭoma*, *ukthtya*, *ṣoḍaśa* and *atirātra*.

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2. *Ukthya:* After performing *Agniṣṭomasāman* when eulogy is performed through *ukthyasāman,* is called *jyotiṣṭoma* of *ukthyasaṁsthā.* The *mantra* through which the *soma* is lifted up is called *ukthya.* The *yāgas* where these *mantras* are used, is called *ukthyasaṁsthā.* Here, three additional *stotras* are used in addition to the twelve *stotras* related to *agniṣṭoma.* In all, fifteen eulogies are used in this *saṁsthā.*

3. *Ṣoḍaśī:* After *ukthyasaṁsthā,* when *ṣoḍaśīstotras* are used, then it is called *ṣoḍaśījyotiṣṭoma.* Sixteen *śāstras*[42] are used in this sacrifice. Therefore, this is also a self explanatory technical term. This *yāga* is not performed independently. It is generally performed in the fourth day of *pṛṣṭhya*[43] and *ṣaḍaha*-sacrifice.[44]

4. *Atirātra*: *Atirātra-jyotiṣṭoma* is that sacrifice where *atirātra-sāmans* are eulogised or rather properly sung.

5. *Atyagniṣṭoma*: Three *yāgas,* namely *atyagniṣṭoma, vājapeya* and *āptoryāma* are serially performed through the *āvāpa* and *udvāpa* of four sacrifices. The sacrifice *agniṣṭoma* is completed with the *mantra*: *yajñāyajñā vo agnaye* etc. When the *stutaśāstra* occurs after the *mantra*: *rājanyasya ṣoḍaśīnam gṛhṇīyāt* recited with reference to *Agnimāruta,* is called *Atyagniṣṭoma*-sacrifice. In this sacrifice, *ṣoḍaśī* is performed after *agniṣṭoma* instead of *ukthya.*

AN INTRODUCTION TO *AHĪNA* AND *SATRA,* ETC.

Dvādaśāhayāga

The sacrifice which is accomplished in twelve days, is called *dvādaśāhayāga.* It is, of two sorts, namely, *ahīna* and *satra.*

The sacrifice *ahīnadvādaśāha* is performed by many *yajamānas,* i.e., sometimes by one, sometimes by two and sometimes by three or more than that. Just like *agniṣṭoma, adhvaryu* etc. are also expected for its performance. The cows are prescribed as *dakṣiṇā* in this sacrifice. The number may be thousand or more than that. All the results of this sacrifice goes to *yajamāna.* Only a *dvija* is entitled to become *yajamāna* in this sacrifice. A sacrifice called *atirātra* is performed after the completion of this sacrifice.

Only a brahmin has the right to perform the *dvādaśāha*-sacrifice in the form of *satra.* Amongst the *brāhmaṇas* also, those who regularly perform *āhitāgni* and *agniṣṭoma* etc., are entitled to perform this sacrifice. Each and every member of this sacrifice is a *yajamāna.* Therefore, all the members are expected to equally contribute the sacrificial oblations. No *dakṣiṇā* is prescribed for this sacrifice, because, all the members are *yajamānas* only. The result of this sacrifice goes to each and every member. If the number of *yajamānas* is seventeen then sixteen are treated as *adhvaryu* and one is treated as *gṛhapati.* Even if the sacrifice is performed by twentyfour *yajamānas,* then also sixteen are treated as *adhvaryus* and rest eight are treated as *gṛhapatis.*

The *dīkṣā* etc., which are meant for *yajamāna,* are applicable to each and every member. The *Atirātrayāga* is performed in the beginning and end of this sacrifice. The *dvādaśāhasatrayāga* is so important that it is even extended (*atideśa*) to other *yāgas* like *gavāmayana* etc. *Dvādaśāha-ahīnayāga* is also extended to other *yāgas* performed in between *dvirātra* and *ekādaśarātra.*

It is important to note here that the terms *ahar* and *rātri* does not refer to day and night respectively. Either of the terms denotes day and night both in this context. Therefore, *dvādaśāha* and *dvādaśarātra* denote a single meaning. Although this *yāga* is called *dvādaśāha,* it is accomplished in thirty six days. However, the term *dvādaśāha* is justified, because a particular type of procedure continues for twelve days. In these thirty six days, *dīkṣā, upasad* and *sutyā* take twelve days each.

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Gavāmayana-satra

Since this *satra* is performed through cows, it is rightly called as *gavāmayana*. The definition and other details of this *satra* are mentioned in *Taittirīyasaṁhitā*,[45] *Aitareyabrāhmaṇa*[46] and *Tāṇḍyabrāhmaṇa*.[47] This sacrifice begins either in *māghakṛṣṇāṣṭamī* or *māghaśukla-ekādaśī* or *caitrapūrṇamāsī* and takes twenty-four days, because twelve *dīkṣās* and twelve *upasads* are performed in it.

Vājapeyasatra

The *brāhmaṇas* and *Kṣatriyas* are entitled to perform this sacrifice barring the *Vaiśyas*. However, the *vājapeya* mentioned under seven *somasaṁsthās*, is applicable to any *dvija* including the *Vaiśyas* also. This sacrifice begins in the autumn season, and *Vanaspatisava* (*yāga*) is performed in the beginning and end of this sacrifice. If *vājapeyasutyā* is performed in the month of *Āśvina* then *vanaspatisava* is performed in *bhādrapada* and *kārtika*. *Vājapeyasutyā* is said to be performed on the newmoon day of Āśvina and Kārtika.

In the third alternative, twelve *yāgas* are performed in the twelve *śuklapakṣas* under this sacrifice. The *agniṣṭoma* is performed in the *śuklapakṣas* of uneven (*ayugma*) months, whereas *pṛṣṭhya* and *sadana* are performed gradually in the *śuklapakṣas* of even (*yugma*) months. In *pṛṣṭhya*, six eulogies (*stotras*), namely *rathantara, bṛhat, vairūpa, vairāja, śakvara* and *raivata* as well as six *ṣṭomas* like *trivṛt, pañcadaśa, saptadaśa, ekaviṁśa, triṇava* and *trayastriṁśā* are gradually performed in six days. After performing the *vājapeya* sacrifice, *agniṣṭoma* is performed in the *śuklapakṣas* of each even months and *pṛṣṭhya* etc. are performed in the *śuklapakṣas* of uneven months in the reverse order.

The purchasing of *soma* and the other means of *surādravya* is prescribed in this sacrifice. The *yajamāna* and the *ṛtviks* arrange a chariot-race which comes under the rules of this sacrifice. The *Brahmā* at that time sits on the still wheel of the chariot and sings the concerned *sāman*.

Rājasūyayajña

Only a king who is sworn in, is entitled to perform this sacrifice and not a *brāhmaṇa* or *vaiśya-Anumati-iṣṭi, malhādipaśuyāga* and the sacred *somayāgas* are performed under this sacrifice. These *yāgas* are prescribed here as prominent and not as subservient, therefore, they should not be treated as *avayavas* and *avayavis*. This sacrifice is accomplished in eight days beginning in *phālgunaśuklapratipad* and ending in *phālgunaśuklāṣṭamī*.

Although the utility of *soma*-juice is prescribed here still since the *yajamāna* is invariably a king here and the *somarasa* is strictly prohibited for him, the *somarasa* is substituted by the juice of the sprouted seeds of pipal tree (*nyagrodha*) by purifying it by *mantras*.

Aśvamedhayajña

Since the horse is accepted as a sacrificial animal in this sacrifice it is etymologically called *aśvamedha*. Only a *sarvabhauma*, i.e., a *cakravartī* king is entitled to perform this sacrifice and not a *brāhmaṇa, vaiśya* or any common king.

This sacrifice can be started in *phālgunaśuklāṣṭamī, phālgunaśuklanavamī*, or any time prescribed in the summer. One thousand cows and four *śatamāna* (approximately 400 *tolās*) of silver is given to each of the four *mahārtviks*. The main horse of this sacrifice should be black in the front half and white in the back half which is adorned with *tripuṇḍra* of the form of a cart (*śakaṭa*). This horse should be extra ordinary and very costly which can be purchased only by the exchange of thousand cows. The movement of the horse is made free so that it can go anywhere it likes and it is followed by four hundred horse riders armed with various weapons for its protection.

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Puruṣamedha

Brāhmaṇas and *Kṣatriyas* are entitled to perform this sacrifice. This is continued for forty days beginning with *caitraśukladaśamī*. Eleven *yūpas*, eleven *agniṣṭomīya* animals and one *puroḍāśa* is needed for this sacrifice. Here many *puruṣas* (males) are required, because eleven *brāhmaṇas* are appointed near each sacrificial post except the middle one where forty *brāhmaṇas* are appointed as mentioned in the *saṁhitā*. In case the *brāhmaṇas* are *yajamānas* then anything can be given as *dakṣiṇā* and when *yajamānas* are either *kṣatriya* or *vaiśya* then the *dakṣiṇā* prescribed for *aśvamedha* will also be applicable for this.

A particular *puruṣa* who is appointed for a particular deity has to offer *ājyāhuti* for the sake of the same deity. After the completion of this sacrifice, the *yajamāna* leaves his home for ever and goes to forest for a *vānaprastha* life.

Sarvamedhayāga

Sarvamedhayāga is accomplished in thirty four days. Twelve *dīkṣās*, twelve *upasads* and ten *sutyā* (a type of *yāga*) are performed in this sacrifice. In the first day, *agniṣṭoma* is performed and in the next three days, *Indrastut*, *Sūryastut* and *Vaiśvadevastut* are gradually performed. *Mahāvrata*, *vājapeya*, *āptoryāma*, *triṇavaṣṭoma*, *traystriṁśatṣṭoma* are performed in the fifth, sixth, seventh, eighth and ninth day respectively. In the tenth day, however, three *yāgas*, namely, *viśvajit*, *sarvapṛṣṭha* and *atirātra* are performed. In this way, this sacrifice continues for thirty four days.

Iṣṭakāpaśu and *ukhāsaṁvaraṇa-vidhi* are prescribed for *caitraśuklaṣaṣṭhi*. Hundred types of *agni*, one *yūpa* and *ṣṭomāyana*-sacrificial animal are also prescribed for this sacrifice which continues for ten days. Only a *dvija* is entitled for this sacrifice.

Pitṛmedhayāga

This sacrifice is also performed only by a *dvija*. The bones of the dead *pitar* are taken to the forest and are arranged in proper place to make a human shape. Then the shape is covered with *kuśa* and *śaivāla*. The *yajamāna* returns home after concluding all sorts of rites including *snāna* etc.

Ekāhayāga

The details of the various types of *ekāhayāga* are available in *adhyāāya* 22 of *Kātyāyanaśrautasūtra*. Some of them are briefly presented in the paragraphs to follow.

Only *dvijas* (*brāhmaṇa*, *kṣatriya* and *vaiśya*) are entitled to perform this sacrifice. The *yajamāna* will be one but like *agniṣṭoma* the *ṛtviks* are sixteen in this sacrifice also. These *yāgas* are also stated under the *agniṣṭoma-saṁsthā*.

Here, a sacrifice called *bhū* which is related to *Agniṣṭoma-saṁsthā* is mentioned first. *Dhenu* is prescribed as *dakṣiṇā* for this sacrifice. Thus, *go*, *jyotiṣ*, *āyus*, *abhijit* and *viśvajit* are mentioned under this category.

After that, four *yāgas*, designated as *sahasra*, are mentioned which are self-explanatory (*anvarthaka*), because, one thousand *mudrās* are given as *dakṣiṇā* in this sacrifice. The sacrifices like *jyotiḥ*, *sarvajyotiḥ*, *viśvajyotiḥ* and *trirātra* are mentioned under this category.

Six *ekāhayāgas* are prescribed under it which are named as *sādyaskra*. The *yāgas* are called so, because all the rites are accomplished from *sadyaḥ*, i.e., the day of *dīkṣā* when *soma* etc. are purchased till the *abhiṣava*. The first two of these *yāgas* are popular by the name *sādyaskra*, while the rest are also separately named as *anukrī*, *viśvajit*, *śilpaśyena* and *ekatrika* respectively.

Four *yāgas* are familiar by the name *Vrātyaṣṭoma*. These are also called *gaṇayāgas*. The *vaṭukas* whose *upanayanasaṁskāra* 'sacred thread ceremony' is not performed at the proper age, are called *vrātyas* (whose *sāvitrīvrata* is violated). Such *vrātyas* are again entitled to

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undergo *upanayana* only by performing the *prāyaścitta* in the form of *vrātyaṣṭoma*. In this manner, the details of all other *ekāhayāgas*, are mentioned in the *Kātyāyanaśrautasūtra*.

This is also an important point to note here that the knowledge of the nature and form of these *ekāhayāgas* is possible on the basis of the seven popular *yāgas* incorporated under the *Jyotiṣṭoma-saṁsthā* of *Soma-yāga*.

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1. The hymn by which the oblations are offered to the deity in a *yāga* after *āvāhana* is called *yājyā*. The *Puronuvākyā* is prescribed first followed by the *yājyā* (vide, *Āśvalāyanaśrautasūtra* 3.7.31). *Puronuvākyā* is nothing but the hymn which is recited in the memory of the deity to welcome and please him in the sacrifice: *Puraḥ yāgāt pūrvam anukūlayitum ucyate iti anuvākyā.*
2. *Na karma-kartṛ-sādhanavaiguṇyāt* (*NS*-2.1.55).
3. It is to be noticed here that *yava* or *akṣata* are used in *kanyādāna* instead of til. Because the *sampradānapuruṣa* or *grahitā* can present or sell out the things which he has received with til and *kuśa*, which is not allowed in case of *kanyādāna*. Here the bar on til, and the mention of the term *patnitva* in the *dāna*-sentence are the *niyāmakas* of this exception. Therefore, the responsibilities like begetting an issue and its maintenance are imposed on the *sampradānapuruṣa*. As a result, such dissimilarity of *kanyādāna* with other *dāna* is essential.

   Thus, the bride who is fully related to her in-law's home is also simultaneously related to her parent's home. On the other hand, the general gifts are completely separated from the giver being only related to the taker.
4. *Vasante brāhmaṇo'gninādadhīta, grīṣme rājanyo varṣāsu vaiśyaḥ,* Kātyāyana-Śrautasūtra—4.7.91.
5. *Tailam dadhi payaḥ somo yavāgur odānam ghṛtam, taṇḍulāḥ phalam āpaśca daśadravyāṇyakāmataḥ//*
6. *Dhūrtasvāmi bhāṣya on Āpastamba-śrauta-sūtra—11.*
7. Cf. *Darśapūrṇamāsāviṣṭīnām prakṛtiḥ*—MS. 24.3.321.
   Iṣṭiṣu darśapūrṇamāsayoḥ pravṛttiḥ syāt—MS. 8.1.11.
8. *Tasmād darśapūrṇamās ayoścatvāraḥ ṛtvijaḥ*—Taittirīya-Saṁhitā 2.3.61.
9. *anantagarbhiṇaṁ sāgram kuśam dvidalam eva ca/*
   pradeśamātram vijñeyam pavitram yatra kutracit-chandogapariśiṣṭa/
10. The earthen pot used for cooking the *puroḍāśa* is called *kapāla*.
11. This is a wooden instrument made of *khadira* and *udumbara* tree and commonly used with all sacrifices. The front portion of this instrument is like a human palm having five fingers and this is smaller than the *juhū* in size.
12. The *śruk* which is also a wooden instrument, the arm of which are made of *palāśa* tree and the front portion is like the beak of the swan, is called *juhū*. Etymologically, it means the instrument by which the oblation is made: *juhotitijuhū*.
13. This is a wooden instrument very much similar to *juhū* and made of peepal tree. This is used by *adhvaryu* to offer oblation. Etymologically *upabhṛt* means: *upa samīpe bhriyate āhriyate iti upabhṛt*.
14. This is also a wooden instrument similar to *juhū* and made of *vikankaṭa* tree. Since this instrument is used starting from the beginning to the end of the sacrifice, this is called *dhruvā*.
15. Eighteen *samidhs* made of *palāśa* tree and as long as *prādeśa* is called *idham*.
16. Handful of *kuśas* consisting of either 16 or 64.
17. The *mantras* by the recitation of which the fire is inflamed.
18. The sprinkling of ghee from one end of the fire to other end.
19. Inviting a particular priest by offering the gifts like *dhautavastra* and *alaṁkaraṇa*.
20. A specific worship of the deities, performed before the main *yāga: prakarṣeṇa ijyante devatā ebhis te prayājāḥ*.
21. *Prāśitram brāhmaṇo bhagastasyāvadānam.*
22. *Anu paścāt āharati—yajñasambandhi-doṣajātam pariharati anena iti.*
23. Vide Sāyaṇa *SV*—1.3.3.5.
24. *Viśve devā apaśyan yat parva tad vaiśvadevam parva.*
25. *Prakṛṣṭo ghāso bhakṣyaviśeṣo yeṣu havirviśeṣeṣu te praghāsāḥ varuṇam uddiśya praghāsāḥ varuṇapraghāsāḥ vidyante yasmin sa varuṇapraghāsāḥ.*
26. *Varuṇasya pāśarūpam karma ghnanti iti varuṇapraghāsās te yasmin vidyante.*

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27. *Sākamedhante vardhante devatā ebhir havirviśeṣair iti sākamedhaḥ.*
28. *Śuno vāyuḥ sīra ādityaḥ tau devate asya.*
29. *Navaprayājam navānuyājam* 5.2.7.
30. *Trīṇi samiṣṭayajūṁṣi* 5.2.9.
31. *Asyaiva vaiśvadevaparvaṇo dharmā uttarayoḥ pravartante* 4.3.4.
32. A container made of Barley powder resembling the shape of a *dīpa.*
33. The *Prasthātā* asks: *Kena carasi?* to *yajamāna's* wife to confess her paramour's name if she has any.
34. *agre navānnotpattyanantaram ayanamā caraṇam yasya ata āgrayaṇam.*
35. *Payograhā Vā syuḥ—Āpastambaśrautasūtra*—19.2.23.
36. *Viśve (sarve) deva ijyante atra.*
37. *Atha śūlagavaḥ—Pāraskara G.S.* 3.81.
38. The *yāga* which is accomplished in twelve days is denoted either by the term *ahīna* or by the term *satra.* Mainly *satra* is used for the *yāga* which is accomplished in more than twelve days. Vide *Śatapathabrāhmaṇa* 4-5.
39. Vide *Pūrvamīmāṁsā* and its sources of G.N. Jha.
40. Now a days *Somalatā* is not availabe in India. It was rarely available even in the ancient period. Therefore, the places where this creeper is available are enlisted in the concerned texts. Today, *pūtikalatā* is substituted for *Somalatā.* The obalations are offered with *pūtikārasa* in place of *somarasa.*
41. Vide *Tāṇḍya-Brāhmaṇa,* 2.4.1.
42. Worshipping the deity with *ṛk-mantras* by *hotā,* who is already worshipped by *sāmamantras* is called *śastra,* vide Tāṇḍya Brāhmaṇa.
43. Six *sāmamantras* namely Bṛhat, *rathāntara vairūpa,* vairāja *śakva* and raivata are called *pṛṣṭhas.* The collection of *pṛṣṭhas* is known as *pṛṣṭhya—Tāṇḍya Brāhmaṇa* 7.6.7 and *Tai. Brā.* 1.2.2.3.
44. *Na vai ṣoḍaśīnāma yajñosti yatra ṣoḍaśam stotram tena ṣoḍaśī—Tai. Saṁhitā* 6.6.11.1.
45. 7.4.8.
46. 4.3.3.
47. 4.11.

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(Translated into English by Dr Banamali Biswal from original Hindi.)

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CHAPTER XXII

Vedic and Upaniṣadic Philosophy

Arvind Sharma

I

To start a paper by stating the difficulties it presents may be poor salesmanship but is also sometimes the requirement of honest scholarship. A paper which claims to trace Advaita in Veda and Vedānta is anachronistic to begin with, for Advaita Vedānta, as a philosophical system, succeeds them. If we then restate our intellectual enterprise as an effort to identify Advaitic elements in the Vedas and the Vedānta, then our difficulties are reduced somewhat, but not removed altogether, for many of the proof texts and ancient teachers which Advaitins claim as representing their traditions are equally claimed by other systems of Vedānta.[1]

Our approach, then, will have to be transparently reductionistic in a historical sense, inasmuch as the best course open to us to meet the challenge of the topic would seem to be the following: (1) to identify what may be called the diagnostic criteria of Advaita, and (2) to locate such materials in the Veda and the Vedānta which answer to it. We are not quite in the clear yet, however, as the identification of the defining features of the Advaita could also prove difficult if not intractable, given the internal diversity of the tradition. Just as the extra-Advaitic external diversity of the Vedāntic tradition created one set of problems, the internal diversity of the Advaitic tradition seems to generate another set of difficulties.[2] The resolution of this difficulty must be frankly arbitrary, in the sense that it must be stipulative: We will have to specify what we intend to take as the defining feature of Advaita, and then proceed to examine the corpus of literature with that lens.

Several propositions can be laid down as characterizing Advaita.[3] It seems to us, however, that two may be selected for our purpose: One because of its specificity or even uniqueness and the other because of its generality or comprehensiveness. The unique element in Advaitic thought, arguably, consists of its identification, as distinguished from equation, of Ātman and Brahman. In terms of Upaniṣadic thought:

> It is represented by the well-known sayings 'That thou art' (*Tat tvam asi*) and 'I am Brahman' (*Aham Brahmāsmi*). They mean that the principle underlying the world as a whole, and that which forms the essence of man, are ultimately the same. Here ended the long Indian quest for the pervasive cause of all things—the search, as the Upaniṣads express it, for 'that by knowing which all will be known.' Passages descriptive of Brahman alone or of ātman alone occur frequently in the Upaniṣads; but they are not peculiar to them, being also found in the earlier literature. Their explicit identification, on the other hand, is specifically Upaniṣadic.[4]

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The general criterion may next be presented as follows: it has the merit of flowing from the previous one, as stated below:

> According to Advaita, nothing is real apart from the absolute spirit, which is referred to by such terms as *Brahman* and *Ātman*. The fundamental teaching of Advaita is therefore, the non-dualism of spirit. Śaṅkara puts the entire philosophy of Advaita in half a verse where he says: *Brahman* is real; the world is an illusory appearance; the individual soul (*jīva*) is *Brahman* alone, not other. The non-duality of *Brahman*, the non-reality of the world, and the non-difference of the soul from *Brahman*—these constitute the teaching of Advaita.[5]

We may now proceed to scour Vedic literature in the light of these criteria. As we do so, however, it might be useful to remind ourselves of a general point,

> that very little of the Revelation literature preceding the Upaniṣads was of systematic interest to the Vedāntins. For example, Śaṅkara quotes less than twenty verses from the entire *Ṛg Veda* in his commentary on the *Brahmasūtras*, about fourteen lines from the largest Brāhmaṇa of them all, the *Śatapatha Brāhmaṇa*, but no less than thirty-four verses from the *Muṇḍaka Upaniṣad*, a fairly minor and short Upaniṣad. This is not to say that Vedānta rejects the previous literature, but that it considers all the relevant wisdom of the Veda concerning these issues to have been embedded in the Upaniṣads.[6]

II

It is received wisdom that the Saṁhitā section of the Vedas, specifically the *Ṛg Veda*, does not possess an Advaitic component. For example, it is claimed that there 'is no thought in these Mantras of the physical universe or my aspect of it being unreal'.[7]

This conclusion has been called into question by V.M. Apte (who is aware of the singularity of his own conclusion). He maintains that the words *māyā* and *rūpa* are used essentially in the *Ṛg Veda* in the same sense as subsequently.[8] His position is best stated in his own words:

> Quite a number of philosophical hymns are contained in the *Ṛg Veda*, and they have been often discussed and translated. An important point to note in this connection is, however, that the terms *māyā* and *rūpa*—on which hinges the whole of later Vedānta philosophy—have been used already in the *Ṛg Veda* precisely in their Vedānta sense, *Rūpa* in the *Ṛg Veda* never signifies real form but only the transient and deceptive *appearance*; and *māyā* in most passages has been used to signify only that occult power by means of which the deceptive appearance can be assumed or discarded. If the doctrine of *māyā* and *rūpa* is the essence of Vedānta (end of Veda), then it may as well be called Vedādi (beginning of Veda).[9]

Even if this view is admitted, it does not imply the presence of other elements of the Advaitic position, as he himself takes pains to clarify:

> The word *māyā* in the *ṚV* generally denotes 'occult power' applicable in the good sense to gods and in a bad sense to demons, and may be rendered by the English word 'craft', having a similar double application. But, as noted above (p. 353), in X.54.2 it is used in the sense of 'illusion' or 'show', thus forestalling later Vedānta philosophy. It may be safely affirmed, however, that the Ṛgvedic tendency is towards a naive realism, not monistic idealism, towards which the general spirit of Indian thought was soon to drift. If X.72.2 says that the 'existent' was produced from the 'non-existent' all that is meant

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is that the manifest arose from out of then on-manifest. If being or non-being is postulated as the first Principle it is strictly from the point of view of the word of experience.[10]

The hymn closer to the Advaitic mark is the so-called Nāsadīya hymn of the *Ṛg Veda* (X.129). According to Deutsch and van Buitenen, 'The hymn exhibits a clear monistic or non-theistic concern, an account of creation that gives special attention to the role of desire, and a kind of skeptical or agnostic attitude concerning man's (and even God's) knowledge of creation.'[11] Perhaps it is worth noting that even in these two latter aspects it is very Advaitic in spirit, as Advaita recognizes the special role of desire[12] and Śaṅkara's indifference to cosmogonal accounts is well known.[13] T.M.P. Mahadevan seems to imply that two famous hymns of the *Ṛg Veda:* the Puruṣasūkta (X.90) and the Nāsadīya (X.129) represent respectively the 'seeds of theism and absolutism that . . . germinate and grow to huge proportions in later Hinduism, and get embellished in great detail'.[14] M. Hiriyanna puts it squarely in the monistic tradition. According to him: 'We are here on the threshold of Upaniṣadic monism.'[15] So also S. Radhakrishnan, according to whom 'The last phrase, "Ko Veda?" ("Who knows?") brings out the mystery of creation which has led later thinkers to call it *māyā*'.[16]

Apart from the hymns, one particular verse has played a major role in the context of Advaita Vedānta; in fact the role is so significant that it has virtually replaced the *gāyatrī* in modern Hinduism. This verse of the *Ṛg Veda* may be translated as follows:

> They call him Indra, Mitra, Varuṇa, and Agni; (they) also (say) that he is the divine Garutmat of beautiful wings. The sages speak of Him who is One in various ways; they call Him Agni, Yama, Mātariśvan.[17]

This verse has been widely employed in modern writings of Hinduism in two context: (1) as a proof-text of Hindu religious tolerance and (2) as an Advaitic text providing the metaphysical basis for such tolerance. Some scholars have criticized its widespread use as an innovation of neo-Hinduism. It is therefore significant that Yāska (700 BC?) invokes this verse to arrive at a monotheistic, in fact, a virtually monistic interpretation of the *Ṛg Veda.* Yāska comments: 'The sages speak of this Agni, the great soul, in many ways.'[18]

It is significant that Yāska tries to explain all the deities of the *Ṛg Veda* in terms of this one *Ātman.*

> *Māhābhāgyād-devatāyā eka ātmā bahudhā stūyate. Ekasya ātmano anye devāḥ pratyaṅgāni bhavanti . . . itaretarajanmāno bhavanti. Itaretara prakṛtayaḥ. Karmajanmānaḥ. Ātmajanmānaḥ . . . Ātmā sarvaṁ devasya*—'It is because of His great divisibility (*māhābhāgyāt*) that they apply many names to Him one after another. The other Angels (*devas*) come to be (*bhavanti*) sub-members (*pratyaṅgāni*) of the One Essence (*ekasyātmanaḥ*). Their becoming is a birth from one another; they are of one another's nature; they originate in function (*karma*); Essence is their origin . . . . Essence (*ātmā*) is the whole of what an Angel is' (VII.4).[19]

The *Atharva Veda* is especially significant for Advaitic thought apart from the recognition of the *Ātman per se* for

> in the *Atharva Veda,* the universal self or world soul is stated to have 'the earth as its feet, the atmospheric region as its belly, the sky for its head, the sun and moon for its eyes and the wind for its breath'. The two conceptions [of Ātman and Brahman] *are also sometimes identified;* and it is this happy identification of them that constitutes the essential teaching of the Upaniṣads.[20]

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III

The Brāhmanas may now be examined for the presence of Advaitic elements. The presence of the Advaitic elements in the Brāhmaṇas is clouded by controversy, so far as Western scholarship is concerned.

> Two divergent views are held by Western scholars regarding the conception of the impersonal Godhead—Brahman as recorded in the Brāhmaṇas. Scholars headed by Max Müller, Deussen etc., maintain that the conception of the unqualified absolute reality is met with in the *Ṛg Veda, Atharva Veda* and the Brāhmaṇas whereas the opposite camp led by Oldenberg, Hertel and the like deny the same. The latter groups lays charge at the door of the Brāhmaṇas that the Absolute as an Impersonal unqualified Supreme Spirit was not known to the authors of the Brāhmaṇas.[21]

Jogiraj Basu, who thus summarizes the opposite positions, is inclined to side with the former group. As proof of the existence of the concept of Brahman as the Absolute in the Brāhmaṇas, he cites the following text (*Śatapatha Brāhmaṇa*, X.4.1.9):

> The great Brahman is One and imperishable; . . . verily, all Gods, all beings finally pass into that imperishable supreme being.[22]

Inasmuch as Advaita not only asserts the reality of Brahman but also identifies Ātman with it, two comments from the Brāhmaṇas become significant: *Brahmaiva sarvam* (*Gopatha Brāhmaṇa* [*Uttarārdha*] 5.25) and *Sarvam hyayamātmā* (*Śatapatha Brāhmaṇa* IV.2.2.1).[23] They seem to identify both Brahman and Ātman with all and thus with each other. Basu, however, goes further and claims that in the following passage from the *Śatapatha Brāhmaṇa* (X.6.3), 'The identification of the Brahman, Ātman, the Soul of man and the soul of the universe, truth, with one another is complete.'[24]

> Let him meditate upon Brahman the Truth, . . . Let him meditate on the Self, Ātman, which is made of intelligence, and endowed with a body of spirit, with a form of light, and with an ethereal nature, which changes its shape at will, is swift as thought, of true resolve, and true purpose, which consists of all sweet colours and tastes, which holds sway over all the regions pervades this whole creation, which is speechless and indifferent—even as a grain of rice, or a grain of barley, or a grain of millet or the smallest granule of millet, so is this golden *Puruṣa* in the heart; even as a smokeless steady column of light, it is greater than the sky, greater than the ether, greater than all existing things; that self of the spirit is my self; on passing away from this world I shall obtain that self.[25]

That Brahman and Ātman are brought in apposition in this passage is clear but whether their identification as such should be considered implicit or explicit is for the reader to judge.

Basu's overall case for the presence of Advaitic elements seems to be strong. He is also able to locate the famous Advaitic doctrine that release can only be obtained by knowledge and through self-realization in the *Śatapatha Brāhmaṇa* (X.5,4.16; III.10,11.1), although the case does pose a hermeneutical problem. Both these ideas are as much Vedāntic as Advaitic, for the theistic schools tend to assimilate *bhakti* within *jñāna* on the basis that devotion is a mental mode and interpret self-realization as the realization by the self of its dependence on God. Nevertheless, if interpreted literally the statements cited above possess a strong Advaitic flavour.

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IV

According to modern scholars the 'two oldest Upaniṣads'[26] are the *Bṛhadāraṇyaka* and the *Chāndogya*. These, however, contain a variety of teachings and perhaps our interests are best served in focusing on the Advaitic elements within them. These can then be compared and evidence from other Upaniṣads of an Advaitic nature could also be incorporated in the discussion, as we progress towards developing a general conclusion on the nature of Advaita in the Upaniṣads.

Advaita in the Bṛhadāraṇyaka Upaniṣad

Yājñavalkya is the central figure in the Upaniṣad and he develops the Advaitic doctrine in the various dialogues, especially those with Gārgī, with King Janaka and his own wife Maitreyī. The main issue is the determination of the ultimate reality; the determination of one's identity; the nature of the relationship of oneself with this reality; and the consequences that flow from different understandings of this relationship.

The ultimate reality in the Upaniṣad is identified with Brahman, also referred to as the Imperishable. The search for the ultimate ground of the universe had led to space as a possible terminus but then Gārgī asked Yājñavalkya. 'Across what then, pray, is space woven, warp and woof?'.[27] Yājñavalkya then identified the Imperishable as the ultimate ground of everything:

> Verily, O Gārgī, that Imperishable is the unseen seer, the unheard Hearer, the unthought Thinker, the ununderstood Understander. Other than it there is naught that sees. Other than It there is naught that hears. Other than It there is naught that thinks. Other than It there is naught that understands. Across this Imperishable, O Gārgī, is space woven, warp and woof.[28]

Earlier, when he was questioned by Uddālaka Āruṇi, Yājñavalkya had identified the Ātman as the subtlemost essence of one's being and also described it as follows:

> He is the unseen seer, the unheard Hearer, the unthought Thinker, the ununderstood Understander. Other than He there is no seer. Other than He there is no hearer. Other than He there is no thinker. Other than He there is no understander. He is your Soul, the Inner Controller, the Immortal. Thereupon Uddālaka Āruṇi held his peace.[29]

Thus not only is the ultimate ground of the universe identified with *Brahman* and of one's own being with *Ātman*, the two are identified as well. The consequence of not understanding this relationship is continued rebirth and that of understanding it is release from rebirth. On this point there is this verse:

> Where one's mind is attached—the inner self
> Goes thereto with action, being attached to it alone.
>
> Obtaining the end of his action,
> Whatever he does in this world,
> He comes again from that world
> To this world of action.
>
> —So the man who desires.

THE SOUL OF THE RELEASED

> Now the man who does not desire—He who is without desire, who is freed from desire, whose desire is satisfied, whose desire is the Soul—his breath do not depart. Being very Brahma, he goes to Brahma.

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On this point there is the verse:

> When are liberated all
> The desires that lodge in one's heart,
> Then a mortal becomes immortal!
> Therein he reaches Brahma![30]

It is, however, in his dialogue with Maitreyī that the empirical implications of the drastic transformation of consciousness involved in this process come to light (IV.5.12-15):

> 12. It is—as the uniting-place of all waters is the sea, likewise the uniting-place of all touches is the skin; likewise the uniting-place of all tastes is the tongue; likewise the uniting-place of all odors is the nose; likewise the uniting-place of all forms is the eye; likewise the uniting-place of all sounds is the ear; likewise the uniting-place of all intentions is the mind; likewise the uniting-place of all knowledges is the heart; likewise the uniting-place of all actions is the hands; likewise the uniting-place of all pleasures is the generative organ; likewise the uniting-place of all evacuations is the anus; likewise the uniting-place of all journeys is the feet; likewise the uniting-place of all Vedas is speech.
>
> 13. It is—as is a mass of salt, without inside, without outside, entirely a mass of taste, even so, verily is this Soul, without inside, without outside, entirely a mass of knowledge.
>
> Arising out of these elements, into them also one vanishes away. After death there is no consciousness (*Saṁjñā*). Thus, lo, say I,' Thus spoke Yājñavalkya.
>
> 14. Then said Maitreyī; 'Herein, indeed, you have caused me, sir, to arrive at the extreme of bewilderment. Verily, I understand It [i.e., this *Ātman*] not.'
>
> Then said he: 'Lo, verily, I speak not bewilderment. Imperishable, lo, verily, is this Soul, and of indestructible quality'.
>
> 15. 'For where there is a duality, as it were, there one sees another; there one smells another; there one tastes another; there one speaks to another; there one hears another; there one thinks of another; there one touches another; there one understands another. But where everything has become just one's own self, then whereby and whom would one see? Then whereby and whom would one smell? Then whereby and by whom would one taste? Then whereby and to whom would one speak? Then whereby and whom would one hear?, Then whereby and of whom would one think? Then whereby and whom would one touch? Then whereby and whom would one understand? Whereby would one understand him by means of whom one understands this All?'[31]

Some other striking features of Advaita as expounded in the *Bṛhadāraṇyaka Upaniṣad* may also be identified: (1) two forms of Brahman are mentioned (II.3.2), a distinction which would undergo considerable development subsequently; (2) the *Ātman* is identified not only as the ultimate fact of one's being but also its ultimate value (II.4.5); (3) the *via negativa* approach is adopted towards defining *Brahman* as *neti neti* (IV.5.15), an approach which undergoes considerable extension later; (4) the word *Brahmaloka* is used both in the sense of the experience of *Brahman* and not as the world of Brahmā (IV.4.23); (5) the knowledge of the immanence of *Brahman* is referred to as *madhuvidyā* or the sweet doctrine (II.5.16) and (6) *Brahman* itself is identified as the source of the scripture (II.4.10), thereby preparing the ground for the foundational role of *śrutiprāmāṇya* in formal Advaita.

No account of Advaita in the *Bṛhadāraṇyaka Upaniṣad* could be considered adequate without a reference to the *madhuvidyā* or the honey doctrine of Dadhyaṅ Ātharvaṇa, especially in light of the fact that the *Atharva Veda* adumbrates and anticipates Advaitic doctrines to begin with.

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This seer seems to have held the doctrine of the mutual interdependence of things because all of them are indissolubly connected in and through the Self. All things are related to one another, because they are bound together by the same basic bond, namely, the Self. 'The earth', says Dadhyach, 'is the honey (*madhu*) of all beings, and all beings are the honey of the earth, just because the same lustrous immortal Self inhabits them both. The fire is the essence of all things, and all things are the essence of the fire, just because the immortal Self is the essence of both.' Similarly are the wind, the sun, the space, the moon, the lightning, the thunder, the ether, and even law and truth and humanity the essence of all things whatsoever and all things are the essence of these, inasmuch as the same law, the same element, the same indissoluble bond, connects them both. Finally, the individual Self is itself the essence of all things and all things are the essence of the individual Self, inasmuch as both of them are held together by the same Universal Spirit. It is this Universal Spirit which is the lord and king of all things. 'As all the spokes are contained in the axle and the belly of a wheel, so are all things and all Selves connected in the Supreme Self.' It is on account of the Supreme Self that all things stand related together. All things appear on the background of this eternal curtain. 'Nothing exists that is not covered by the Supreme Self. He becomes like unto every form, and all the forms are only partial revelations of Him. The Lord appears many through his powers,' Thus does Dadhyach teach the doctrine of the supreme existence of the one, and the apparent existence of the Many.[32]

Advaita in the Chāndogya Upaniṣad

The two main dialogues involving Advaitic doctrines consist of Indra's dialogue with Prajāpati and of Uddālaka's with Śvetaketu. Indra wants to know the true nature of the Self, and also of the demons. Prajāpati, the instructor, initially identifies it with the body. The demons accept this, but Indra develops doubts and returns. This process is repeated as Prajāpati identifies the Self with the dreaming subject and then with dreamless sleep. When Indra is still not satisfied, he is rewarded with the revelation of the true identity of the Self:

4. Now, when the eye is directed thus toward space, that is the seeing person (*cakṣuṣa puruṣa*); the eye is [the instrument] for seeing. Now, he who knows 'Let me smell this'—that is the Self (*Ātman*); the nose is [the instrument] for smelling. Now, he who knows 'Let me utter this'—that is the Self; the voice is [the instrument] for utterance. Now, he who knows 'Let me hear this'—that is the Self; the ear is [the instrument] for hearing.

5. Now, he who knows 'Let me think this'—that is the Self; the mind (*manas*) is his divine eye (*daiva cakṣu*). He, verily, with that divine eye the mind, sees desires here, and experiences enjoyment.

6. Verily, those gods who are in the Brahman-world reverence that Self. Therefore, all worlds and all desires have been appropriated by them. He obtains all worlds and all desires who has found out and who understands that Self (*Ātman*).

Thus spoke Prajāpati—yea, thus spoke Prajāpati![33]

Similarly, Nārada approaches Sanatkumāra for further instruction after acquiring traditional learning. His led through various formulations of reality to the ultimate reality of the *Ātman*.

Now, next, the instruction with regard to the soul (*ātmādeśa*).

The soul (*Ātman*), indeed, is below. The Soul is above. The Soul is to the west. The Soul is to the east. The Soul is to the south. The Soul is to the north. The Soul, indeed, is this whole world.

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Verily, he who sees this, who thinks this, who understands this, who has pleasure in the Soul, who has delight in the Soul, who has intercourse with the Soul, who has bliss in the Soul—he is autonomous (*sva-rāj*); he has unlimited freedom in all worlds. But they who know otherwise than this are heteronomous (*anya-rājan*); they have perishable worlds; in all worlds they have no freedom.[34]

The identification of oneself with the ultimate reality occurs in the dialogue between Uddālaka and Śvetaketu. Śvetaketu is given a series of lessons which end in the same teaching: 'That thou art, Śvetaketu' (*Tat tvam asi*). An example:

'Place this salt in the water. In the morning come unto me.'

Then he did so.

Then he said to him: 'That salt you placed in the water last evening—please bring it hither.

Then he grasped for it, but did not find it, as it was completely dissolved.

2. 'Please take a sip of it from this end,' said he, 'How is it?'

'Salt,'

'Take a sip from the middle,' said he. 'How is it?'

'Salt.'

'Take a sip from that end,' said he. 'How is it?'

'Salt.'

'Set it aside. Then come unto me.'

He did so, saying, 'It is always the same.'

Then he said to him: 'Verily, indeed, my dear, you do not perceive Being here. Verily, indeed, it is here.

3. That which is the finest essence—this whole world has that as its soul. That is Reality. That is *Ātman* (Soul). That art thou, Śvetaketu.'

'Do you, sir, cause me to understand even more.'

'So be it, my dear,' said he.[35]

This Upaniṣad contains two other accounts which are significant from a social point of view in the history of Advaita. In one of them the student, Satyakāma, is accepted as one by Hāridrumata Gautama, even though Satyakāma's paternity is uncertain; in the other Raikva instructs Jānaśruti although Jānaśruti is a *śūdra*. Apparently, in the Upaniṣadic period *śūdras* were not ineligible for instruction in Vedic lore.

Comparison of Advaita in the Bṛhadāraṇyaka and the Chāndogya

Thomas J. Hopkins has drawn attention to the fact that, although both Yājñavalkya and Uddālaka agree on the ultimacy and identity of *Brahman* and *Ātman* and on the nature of the saving knowledge which 'is obscured by the condition of the embodied self', they 'differ . . . in their assessment of this condition, expressed in their view of how the Self is caught up in the world of phenomena and how it can eventually be freed from transmigration.'[36]

According to Yājñavalkya the Self is caught up in the phenomenal world because of the 'subtle self' whose 'characteristic mark'[37] is mind, with which the empirical being identifies

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'from one waking state to the next'. What fuels this movement is desire and the cessation of desire brings release. According to Uddālaka, the human being is absorbed, as it were, in the existent or truth (he uses the word *sat* for Brahman)[38] 'but the merger is not complete unless thee is prior knowledge of the real'.[39] Thus without the liberative knowledge of identity with it, beings still cling to phenomenal existence 'and thus retaining the perception of duality, they must return again to a manifested state until they are finally cleansed of all ignorance and have at death only the pure knowledge of the Self'.[40] One might say that, Yājñavalkya has a more linear view of rebirth and Uddālaka a more cyclic one (actually 'recycled' might be a better word).

This difference accounts for their essentially similar yet somewhat different presentations of how knowledge leads to liberation. In Yājñavalkya's view 'the perpetuation of embodied existence is caused by desire'[41] while 'release is effected only by the knowledge that counteracts the self-perpetuation of the embodied self'[42] through desire. In Uddālaka's view ignorance is more directly responsible but 'both agree that it can only be ended by proper knowledge'.[43]

Two other differences in nuance with respect to some other aspects of Advaita may be noted. Vedic authority is both more emphatically asserted (IV.5.11) and questioned (IV.3.22) in the *Bṛhadāraṇyaka* than *Chāndogya*. And the *Chāndogya* is more congenial to a *pariṇāmavāda* type of cosmogenesis (VI.1) while *Bṛhadāraṇyaka* to a *vivartavāda* type (I.2).

Advaita in the Māṇḍūkya Upaniṣad

The contribution of this Upaniṣad to Advaitic thought is twofold: (1) the identification of the *Ātman* both as underlying the experience of three states of consciousness (*avasthātraya*) and as transcending it (*turīya*), thereby providing an experiential basis for Advaita and (2) integrating the *Oṁ mantra* with this scheme and thereby impregnating it with Advaitic mystic symbolism. This result is achieved by identifying each of the three states of waking, dreaming and deep sleep with its audible syllables *A*, *U* and *M* and the transcendental with the silence thereafter.[44]

Later Advaita would also develop macrocosmic correlates to the microcosmic ones but here only the subjective dimension is developed.[45]

This Upaniṣad is among the shortest, but its contribution to Advaitic thought is in inverse proportion to its size.[46]

The contribution of the Upaniṣads which have been mentioned so far is foundational for Advaita. There are a few other Upaniṣads which have also contributed to Advaitic thought, but their contribution to Advaitic thought as such may be considered substantial but equivocal, in the sense that they lend themselves to both an absolutist and a theistic interpretation. For that matter, even what we have considered solidly Advaitic Upaniṣads have also been interpreted non-absolutistically by other schools of Vedānta but the balance of scholarly, as distinguished from scholastic, opinion tends to regard the *Bṛhadāraṇyaka*, the *Chāndogya* and the *Māṇḍūkya* as essentially absolutistic in nature and others such as the *Muṇḍaka*, *Kaṭha* and *Śvetāśvatara* as essentially theistic. It should not be forgotten, however, that the theistic may pave the way for the absolutistic approach.[47]

The *Taittirīya Upaniṣad* is significant in that it stands on the border of this philosophical division, and is capable of being understood Advaitically or non-Advaitically with equal ease. It may now be examined.

Advaita in the Taittirīya Upaniṣad

The main contribution of the *Taittirīya Upaniṣad* to the study of Advaita is the doctrine of the *pañcakośas* or the five sheaths: constituted of food, breath, mind, understanding and bliss (*anna, prāṇa, manas, vijñāna* and *ānanda*) apart from the human being itself being

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described as a sheath of *Brahman* veiled by intelligence (I.4.1., *kośo'si medhayāpihitaḥ*) on the analogy of a god so described. The contribution, however, is not an unequivocal one as later Vedāntins interpret the scheme differently, with Advaitins placing the experience of *Brahman* beyond *Ānanda* and others within it.[48]

Similarly, in the account of the final world mentioned in the scheme of the successively superior gradations of bliss at the different levels the word employed is *ānandam brāhmaṇo*, bliss could mean either the bliss of *Brahman* or of Brahmā.

The Upaniṣad also contains a celebrated definition of *Brahman*: *satyaṁ jñānamanantaṁ Brahma* (II.1). However, this definition can be interpreted both Advaitically and non-Advaitically.

Despite the affiliative ambiguity in terms of schools of Vedānta, it must be recognized that the definition of *Brahman*[49] in this Upaniṣad and its doctrine of *pañcakośas* played a major role in the evolution of subsequent Advaitic thought.

Advaita in other Upaniṣads

Certain portions of other Upaniṣads are either themselves significant or have proved significant for later Advaitic thought. The *Muṇḍaka Upaniṣad*, for instance, distinguishes between two levels of knowledge, the lower and the higher (I.1.4-5). This epistemological distinction may have paved the way for the ontological distinction between the two levels of truth in later Advaita. Similarly, this also provides an example of what Radhakrishnan has called 'a double attitude towards Vedic authority' in the Upaniṣads, in which one finds the seeds of the later doctrine of *mithyātva* of the Vedas.[50] Similarly, the *Kaṭha Upaniṣad*, in some sections (II.3-4), identifies the *Ātman* as the ultimate constituent of human personality. In the *Maitrāyaṇī Upaniṣad* several forms of Brahman are mentioned: (1) material and immaterial; (2) food and food-eater; (3) time and timeless, and (4) word and non-word. Some of these obviously carry Advaitic implications.[51]

On the basis of these materials it is possible to construct a profile in terms of Advaitic psychology[52] or philosophy[53] or soteriology[54] or epistemology,[55] as many scholars have demonstrated; and the same can be attempted for the Upaniṣads as a whole—a point which cannot be elaborated here for want of space. The pioneering work of R.D. Ranade in this field, however, must be mentioned even within these limitations.[56]

V

Conclusion

S. Radhakrishnan has remarked that 'the advance of the Upaniṣads on the Vedas is an increased emphasis on the monistic suggestions of the Vedic hymns, a shifting of the centre from the outer to the inner world, a protest against the externalism of the Vedic practices and an indifference to the sacredness of the Veda.'[57] It will be obvious to the reader that these trends were essentially Advaitic in character.

One special point may be added to these general remarks. Although later Hinduism is dominated by the doctrine of *karma* and rebirth and Advaita is *one* of the many systems of thought found within it; it is remarkable that the situation in Vedic and Vedāntic Hinduism is the reverse; that Advaitic elements are present throughout and the doctrine of *karma* and rebirth seems to surface *after* these elements have appeared!

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1. Karl H. Potter, ed., *Advaita Vedānta up to Śaṅkara and His Pupils,* Motilal Banarsidass, Delhi, 1981, p. 9. Buddhist literature is a rather limited resource in this context, see Hajime Nakamura, *A History of Early Vedānta Philosophy,* Motilal Banarsidass, Delhi, 1983, p. 136, etc.; even Beni Madhab Barua's *History of Pre-Buddhistic Philosophy,* University of Calcutta, 1921, proves to be a limited resource (but see, pp. 164, 172, 183). Similarly, the indigenous Advaitic tradition also serves as a very limited resource; see Sangam Lal Pandey, *Pre-Śaṅkara Advaita Philosophy,* Darshan Peeth, Allahabad, 1983.
2. Karl H. Potter, op. cit., p. 6.
3. Ibid.
4. M. Hiriyanna, *The Essentials of Indian Philosophy,* George Allen & Unwin Ltd., London, 1949, p. 21. It is true that other systems of Vedānta have their own understanding of this identification (ibid., pp. 184, 190, 192). What one has in mind here is its unqualified acceptance in Advaita.
5. T.M.P. Mahadevan, *Outlines of Hinduism,* Chetana Limited, Bombay, 1971, p. 141.
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41. Ibid.
42. Ibid., p. 46.
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46. See K.A. Krishnaswami Aiyer, 'Philosophy of Advaita', in Haridas Bhattacharyya, ed., op. cit., Vol. III, pp. 219-36. In this context Gauḍapāda's commentary on the *Māṇḍūkya* is of special significance; for a critical assessment see S.K. Velvalkar and R.D. Ranade, op. cit., pp. 325-6. On the central role of the analysis of the three states of consciousness in Advaita see S.K. Belvalkar and R.D. Ranade, op. cit., p. 373-5.
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CHAPTER XXIII

Astronomy and its Role in Vedic Culture

Subhash Kak

That astronomy played a very central role in Vedic culture is apparent from the innumerable references to nakṣatras and devas (heavenly bodies) in the earliest texts and the continuing cycle of ceremonies related to the calendar. Vedic astronomy was not based on the use of accurate clocks, but fine time units were defined in relation to events across longer durations. To preserve correspondence between lunar and solar years, intercalary months were inserted at regular intervals.[1]

Astronomy is one of the six Vedāṅgas, subsidiary sciences, of the Vedas, the others being phonetics, ritual, etymology, grammar and metrics. The beginnings of these sciences are to be traced to the earliest parts of the Vedic literature; but the Vedāṅgas have come down to us in late forms in aphoristic *sūtra* style. The construction of altars and the performance of ritual, kalpa, had an astronomical basis and we also find valuable astronomical information in the Śulbasūtras, which are a part of the Kalpasūtras. Two old names for astronomy are jyotiṣa, 'the science of light', and nakṣatra vidyā, 'the science of stars'.

This article describes the position of astronomy in the larger knowledge system of the Vedic Indians. It also sketches the elements of the formal astronomy represented in the Vedāṅga Jyotiṣa, the earliest extant manual describing the motions of the sun and the moon.

1. THE VEDIC SYSTEM OF KNOWLEDGE

When the Vedic Saṁhitās are taken together with the Brāhmaṇas, Āraṇyakas, Upaniṣads, and Sūtras as well as the Vedāṅgas and the Upavedas, this body of texts encompasses a variety of sciences, psychology, and cosmology. The uniqueness of this knowledge arises from the multifarious interrelationships between the parts and how these parts are related to the whole. To understand any single Vedic text, it is essential to know the Vedic system of knowledge. This system has a recursive nature where patterns and metaphors are repeated at different levels of description.

At the broadest level the classification of knowledge is in terms of aparā (material) and parā (transcendental). Speech and language are considered to have four forms,[2] of which one kind, the parā, is unmanifest. In other words it is believed that ordinary language cannot express all aspects of the nature of reality. The Saṁhitās and their commentaries are meant to lead to parā knowledge whereas the Vedāṅgas and the Upavedas deal with aparā knowledge. The Saṁhitās teach through paradox and riddle.

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Several texts mention that the Vedas are eternal or apauruṣeya. We are told that Prajāpati, Time, created the Vedas. It is stated that three lights (*jyotis*), Agni, Vāyu, and Āditya, were first produced.[3] Agni was born from the earth, Vāyu from the atmosphere, Āditya from the sky. Ṛgveda was thereafter produced from Agni, Yajurveda from Vāyu, and *Sāmaveda* from Āditya. From these three pure sounds were born: *bhūḥ* from the Ṛc, *bhuvaḥ* from the Yajus, and *svar* from the Sāman. From these, in turn, come the sounds *a*, *u*, and *m*, which when taken together form the syllable *om*. This creation process clearly alludes to an astronomical basis. The ṛṣis are stars but they have counterparts in the firmament of consciousness. The hymns attributed to the ṛṣis are to be taken to have been seen in the inner space. The theory that the Vedas are non-human implies that the knowledge they represent is eternal, not that the hymns have been in existence for ever. From another perspective, the Vedic chants and symbols represent archetypes of human consciousness, and it is in this sense that the Vedic knowledge is to be considered eternal.

The notion of equivalence or connection (*bandhu*) amongst the adhidaiva (devas or stars), adhibhūta (beings), and adhyātma (spirit) plays a central role in the Vedic system of knowledge. These connections, between the astronomical, the terrestrial, the physiological and the psychological, represent the constant theme in the discourse of the texts. They are usually stated in terms of vertical relationships, representing a recursive system; but they are also described horizontally across hierarchies where they represent metaphoric or structural parallels. Most often, the relationship is defined in terms of numbers or other characteristics. An example is the 360 bones of the infant—which later fuse into the 206 bones of the adult—and the 360 days of the year. Likewise, the tripartite division of the cosmos into earth, space, and sky is reflected in the tripartite psychological aspects of tamas, rajas and sattva.[4]

Although the Vedic books speak often about astronomical phenomena, it is only recently that the astronomical substratum of the Vedas has been examined.[5] One can see a plausible basis behind many connections. Research has shown that all life comes with its inner clocks. Living organisms have rhythms that are matched to the periods of the sun or the moon. There are quite precise biological clocks of 24-hour (according to the day), 24 hour 50 minutes (according to the lunar day since the moon rises roughly 50 minutes later every day) or its half representing the tides, 29.5 days (the period from one new moon to the next), and the year. Monthly rhythms, averaging 29.5 days, are reflected in the reproductive cycles of many marine plants and those of animals. The menstrual period is a synodic month and the average duration of pregnancy is nine synodic months. There are other biological periodicities of longer durations. These connections need not be merely numerical. In its most general form is the Upaniṣadic equation between the self (ātman) and the universe (brahman)

It is tempting to view *jyotiṣa*, the science of light, as the fundamental paradigm for the Vedic system of knowledge. Jyotiṣa is a term that connotes not only the light of the outer world, but also the light of the inner landscape. Astronomy is best described as nakṣatra-vidyā of the Chāndogya Upaniṣad, but because of its popularity we will also use jyotiṣa in its narrow meaning of astronomy. As defining our place in the cosmos and as a means to understand the nature of time, astronomy is obviously a most basic science.

That astronomy reveals that the periods of the heavenly bodies are incommensurate might have led to the notion that true knowledge lies beyond empirical aparā knowledge. On the other hand, it is equally likely that it was a deep analysis of the nature of perception and the paradox of relationship of the preceptor to the whole that was the basis of Vedic thought, and the incommensurability of the motions in the sky was a confirmation of the insight that knowledge is recursive. This Vedic view of knowledge seems to have informed the earliest hymns so it does not appear to be feasible to answer the question of which came first. Neither can we now answer the question whether jyotiṣa as pure astronomy was a precursor to a jyotiṣa that included astrology.

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Analysis of texts reveals that much of Vedic mythology is a symbolic telling of astronomical knowledge. Astronomy was the royal science not only because it was the basis for the order in nature, but also because the inner space of man, viewed as a microcosm mirroring the universe, could be fathomed through its insights.

1.1 *Of Ceremonies, Festivals, Rites*

The importance of jyotiṣa for agriculture and other secular purposes are obvious and so we begin with a brief account of rites and festivals. These ceremonies and rituals reveal that there existed several traditions of astronomical lore; these variations are marked by the different books of Śrautasūtra. Such variation is perfectly in accord with an age when astronomy was a living science with different scholars providing different explanations. Since our purpose is not to go into the details of the Vedic texts, we will describe ceremonies and rites selectively.

Different points in the turning year were marked by celebrations. The year, beginning with the full moon in the month Phālguna (or Caitra), was divided into three four-monthly, *cāturmāsya,* sacrifices. Another way of marking the year is by a year-long dīkṣā. The year was closed with rites to celebrate Indra Śunāśīra (Indra with the plough) to 'obtain the thirteenth month', this thirteenth month was interposed twice in five years to bring the lunar year into harmony with the solar year. This closing rite is to mark the first ploughing, in preparation for the next year. Symbolically, this closing was taken to represent the regeneration of the year.

Year-long ceremonies for the king's priest are described in the Atharvaveda Pariśiṣṭa; these include those for the health of horses, the safety of vehicles, and so on. There existed other royal rites such as rājasūya, vājapeya and the aśvamedha, the so-called horse sacrifice, which actually represented the transcendence by the king of time in its metaphorical representation as horse. The primary meaning of aśva as the sun is attested to in the Ṛgveda, *Nirukta,* and Śatapatha Brāhmaṇa.[6]

The Gṛhyasūtras describe rites that mark the passage of the day such as the daily agnihotra. Three soma pressings, at sunrise, midday and sunset, were a part of the daily ritual of agniṣṭoma. Then there were the full and new moon ceremonies. Longer soma rites were done as sattras, sessions of twelve days or more.

1.2 *Altars*

Altar ritual was an important part of Vedic life and we come across fire altars in the Ṛgvedic hymns. Study of Vedic ritual has shown that the altar, adhiyajña, was used to show the connections between the astronomical, the physiological and the spiritual, symbolically. That the altars represented astronomical knowledge is what interests us in this article. But the astronomy of the altars was not systematically spelled out although there are pointed references in many texts including the tenth chapter of Śatapatha Brāhmaṇa entitled Agnirahasya. The Ṛgveda itself is viewed as an altar of mantras in the Śulbasūtras.[7]

Altars were used in relation to two basic types of Vedic ritual: Śrauta and Gṛhya. This ritual marked specific points in the day or the year as in the soma rituals of agniṣṭoma and agnicayana.[8] Śatapatha Brāhmaṇa describes the twelve-day agnicayana rite that takes place in a large trapezoidal area, called the mahāvedi, and in a smaller rectangular area to the west of it, which is called the prācīnavaṁśa or prāgvaṁśa. The text says clearly that agnicayana represents ritual as well as knowledge.[9]

The mahāvedi trapezium measures 30 prakrama on the west, 24 prakrama on the east, and 36 prakrama lengthwise. The choice of these number is related to the sum of these three equaling one fourth the year or 90 days.

The nominal year of 360 days was used to reconcile the discrepancies between the lunar and solar calendars, both of which were used. In the mahāvedi, a brick altar is built to

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represent time in the form of a falcon about to take wing, and in the prācīnavaṁśa there are three fire altars in specified positions, the gārhapatya, āhavanīya, and dakṣiṇāgni. The gārhapatya, which is round, is the householder's fire received from the father and transmitted to the descendants. It is a perpetual fire from which the other fires are lighted. The dakṣiṇāgni is half-moon shaped; it is also called the anvāhāryapacana where cooking is done. The āhavanīya is square. Between the āhavanīya and the gārhapatya a space of a rough hourglass is dug out and strewn with grass; this is called the vedi and it is meant for the gods to sit on.

During the agnicayana ritual the old āhavanīya serves the function of the original gārhapatya. This is the reason why their areas are to be identical although one of them is round and the other square. In addition eight dhiṣṇya hearths are built on an expanded ritual round (Fig. 1).

Agnicayana altars are supposed to symbolize the universe.[10] Gārhapatya represents the earth, the dhiṣṇya hearths represent space, and the āhavanīya altar represents sky. This last altar is made in five layers. The sky is taken to represent the universe, therefore it includes space and earth. The first layer represents the earth, the third the space, and the fifth the sky. The second layer represents the joining of the earth and space, whereas the fourth layer represents the joining of space and sky.

Time is represented by the metaphor of a bird. The months of the year were ordinarily divided into six seasons unless the metaphor of the bird for the year was used when hemanta and śiśira were lumped together. The year as a bird had the head as vasanta, the body as hemanta and śiśira, the two wings, as śarada and grīṣma, and the tails as varṣā.

The Vedic sacrifice is meant to capture the magic of change, of time in motion. Put differently, the altar ritual is meant to symbolize the paradoxes of separation and unity, belonging and renunciation, and permanence and death. The yajamāna, the patron at whose expense the ritual is performed, symbolically represents the universe.

The ritual culminates in his ritual rebirth, which signified the regeneration of his universe. In other words, the ritual is a play dealing with paradoxes of life and death enacted for the yajamāna's family and friends. In this play, symbolic deaths of animals and humans, including the yajamāna himself, may be enacted.

1.3 *Evolution of Vedic Thought*

How did the use of altars for a symbolic representation of knowledge begin? This development is described in the Purāṇas where it is claimed that the three altars were first devised by the king Purūravas. The genealogical lists of the Purāṇas and the epics provide a framework in which the composition of the different hymns can be seen.[11] The ideas can then be checked against social processes at work as revealed by textual and archaeological data.

As we will see later in this article, there existed an astronomical basis to the organization of Ṛgveda itself; this helps us see Vedic ritual in a new light. That astronomy could be used for fixing the chronology of certain events in the Vedic books was shown more than a hundred years ago by Tilak and Jacobi.[12] This internal evidence compels the conclusion that the prehistory of the Vedic people in India goes back to the fourth millennium and earlier. On the other hand, new archaeological discoveries show a continuity in the Indian tradition going as far back as 8000 BC.[13] These are some of the elements in accord with the view that the Vedic texts and the archaeological finds relate to the same reality.

Recent archaeological discoveries establish that the Sarasvatī river dried up around 1900 BC, which led to the collapse of the Harappan civilization that was principally located in the Sarasvatī region. Francfort has even argued that the Dṛṣadvatī was already dry before 2600 BC.[14] The region of the Sarasvatī and the Dṛṣadvatī rivers, called Brahmāvarta, was especially sanctified and Sarasvatī was one of the mightiest rivers of the Ṛgvedic period. On the other

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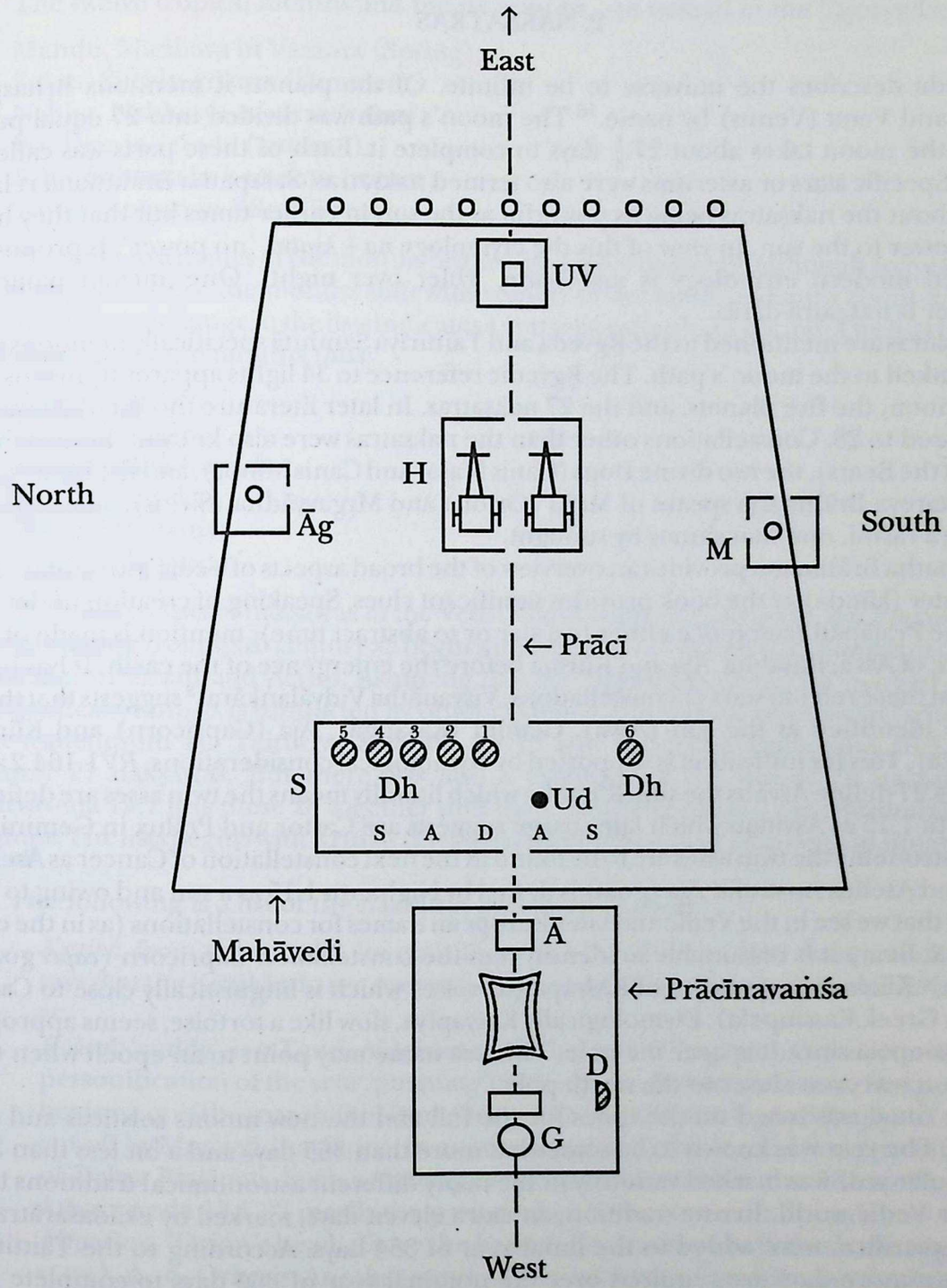

Fig. 1: The Plan for the Altars. Ā: Āhavanīya; G: Gārhapatya; D: Dakṣiṇāgni; UV: Uttaravedi; Dh: Dhiṣṇya hearths which include Āg: Āgnīdhra and M: Mārjālīya; H: Havirdhāna shed.

hand, the Pañcaviṁśa Brāhmaṇa describes the disappearance of Sarasvatī in the sands at a distance of forty days on horseback from its source.[15] With the understanding of the drying up of Sarasvatī it follows that the Ṛgvedic hymns are generally anterior to 1900 BC but if one accepts Francfort's interpretation of the data on the Dṛṣadvatī then the Ṛgvedic period includes the period before 2600 BC.

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2. NAKṢATRAS

The Ṛgveda describes the universe to be infinite. Of the planets it mentions Bṛhaspati (Jupiter) and Vena (Venus) by name.[16] The moon's path was divided into 27 equal parts, although the moon takes about 27 $\frac{1}{3}$ days to complete it. Each of these parts was called a nakṣatra. Specific stars or asterisms were also termed nakṣatras. Śatapatha Brāhmaṇa relates a story[17] about the nakṣatras being as powerful as the sun in earlier times but that they have lost this power to the sun. In view of this the etymology *na + kṣatra,* 'no power', is proposed. A favoured modern etymology is *nak–kṣatra,* 'ruler over night'. One ancient name of astronomer is nakṣatra-darśa.

Nakṣatras are mentioned in the Ṛgveda and Taittirīya Saṁhitā specifically mentions that they are linked to the moon's path. The Ṛgvedic reference to 34 lights apparently means the sun, the moon, the five planets, and the 27 nakṣatras. In later literature the list of nakṣatras was increased to 28. Constellations other than the nakṣatras were also known; these include the Ṛkṣas (the Bears), the two divine Dogs (Canis Major and Canis Minor), and the Boat (Argo Navis). Aitareya Brāhmaṇa speaks of Mṛga (Orion) and Mṛgavyādha (Sirius). The moon is called sūrya raśmi, one that shines by sunlight.

Śatapatha Brāhmaṇa provides an overview of the broad aspects of Vedic astronomy. The sixth chapter (kāṇḍa) of the book provides significant clues. Speaking of creation under the aegis of the Prajāpati (reference either to a star or to abstract time), mention is made of the emergence of Aśva, Rāsabha, Aja and Kūrma before the emergence of the earth. It has been argued that these refer to stars or constellations. Viśvanātha Vidyālaṅkāra[18] suggests that these should be identified as the sun (Aśva), Gemini (Rāsabha), Aja (Capricorn) and Kūrma (Cassiopeia). This identification is supported by etymological considerations. *RV* 1.164.2 and Nirukta 4.4.27 define Aśva as the sun. Rāsabha which literally means the twin asses are defined in Nighaṇṭu 1.15 as Aśvinau which later usage suggests are Castor and Pollux in Gemini. In Western astronomy the twin asses are to be found in the next constellation of Cancer as Asellus Borealis and Asellus Australis. Aja (goat) is defied by Nighaṇṭu 1.15 as a sun and owing to the continuity that we see in the Vedic and later European names for constellations (as in the case of the Great Bear) it is reasonable to identify it as the constellation Capricorn (*caper* goat + *cornu* horn). Kūrma is a synonym of Kaśyapa (tortoise) which is linguistically close to Casiopeia (from Greek Kassiopeia). Etymologically Kaśyapīya, slow like a tortoise, seems appropriate for Cassiopeia since it is near the pole. This last name may point to an epoch when this constellation was even closer to the north pole.

Vedic ritual was based on the times for the full and the new moons solstices and the equinoxes. The year was known to be somewhat more than 365 days and a bit less than 366 days. The solar year was marked variously in the many different astronomical traditions that marked the Vedic world. In one tradition, an extra eleven days, marked by ekādaśarātra or eleven-day sacrifice, were added to the lunar year of 354 days. According to the Taittirīya Saṁhitā, five more days are required over the nominal year of 360 days to complete the seasons, adding that four days are too short and six days are too long. In other traditions, Gavāmayana, 'the walk of cows or intercalary periods', varied from 36 days of the lunar sidereal year of 12 months of 27 days, to 9 days for the lunar sidereal year of 13 months of 27 days to bring the year in line with the ideal year of 360 days; additional days were required to be in accord with the solar year.

The year was divided into two halves: uttarāyaṇa, when the sun travels north, and dakṣiṇāyana, when the sun travels south. According to the Kauṣītaki Brāhmaṇa, the year-long sacrifices began with the winter solstice, noting the occurrence of the summer solstice, viṣuvant, after six months.

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The twelve tropical months and the six seasons, are named in the Yajurveda:

Mahdu, Madhava in Vasanta (Spring);
Śukra, Śuci in grīṣma (Summer);
Nabha, Nabhasya in varṣā (rains);
Iṣa, Ūrja in śarada (autumn);
Saha, Sahasya in hemanta (winter);
Tapa, Tapasya in śiśira (freeze).

The nakṣatra names of the months began with Caitra in spring, although some lists begin with Phālguna. Since the months shift with respect to the twelve nakṣatra about 2,000 years per nakṣatra, this change in the lists indicates a corresponding long period. The lists that begin with Caitra mark the months thus:

Caitra, Vaiśākha,
Jyaiṣṭha, Āṣāḍha,
Śrāvaṇa, Bhādrapada,
Āśvina, Kārttika,
Mārgaśira, Pauṣya,
Māgha, Phālguna.

The earliest lists of nakṣatras in the Vedic books begin with Kṛttikās, the Pleiades; much later lists dating from sixth century AD begin with Aśvini when the vernal equinox occurred on the border of Revatī and Aśvini. Assuming that the beginning of the list marked the same astronomical event, as is supported by other evidence, the earliest lists should belong to the third millennium BC. Taittirīya Saṁhitā 4.4.10 and Śatapatha Brāhmaṇa 10.5.4.5 each mention 27 nakṣatras. But there was also a tradition of the use of 28 nakṣatras. The Atharvaveda 19.7 lists these 28 together with their presiding deities; the additional nakṣatra is Abhijit. The lists begins with Kṛttikā (Pleiades) where the spring equinox was situated at that time.[19]

The following is a list of the nakṣatras and their locations:

1. *Kṛttikā*, from the root *kṛt*, 'to cut'. These are the Pleiades. The Śatapatha Brāhmaṇa says that the Kṛttikās do not swerve from the east; this indicates early third millennium BC.
2. *Rohiṇī*, 'ruddy', is α Tauri, Aldebaran. The legend of Prajāpati, Orion, considered the personification of the year, pursuing his daughter, Rohiṇī, refers to the age when the beginning of the year shifted from Orion to Rohiṇī. In this legend Prajāpati's head was cut off by Mṛgavyādha, Sirius. In another version of this legend Śiva cuts off the head of Dakṣa Prajāpati. Such a shifting of the year occurred in the fifth millennium BC. Atharvaveda 13.1.22 recalls the period when the sun rose in Rohiṇī.
3. *Mṛgaśīrṣa*, 'Orion's head'. Since the head of Orion was cut off, this is the region of the stars λ, ϕ_1, ϕ_2 Orionis. Another name of this nakṣatra is Āgrahāyana, 'the beginning of the year', which is a cognate of the word Orion. The vernal equinox lay in Orion around 4500 BC.
4. *Ārdrā*, 'moist', is the brilliant star Betelgeuse, α Orionis.
5. *Punarvasū*, 'the two that give wealth again', are the stars Castor and Pollux, or α and β Geminorum.
6. *Tiṣya*, 'pleased', or *Puṣya*, 'flowered', refers to the age when these stars α, β, γ, δ Cancri, formed the background to the sun during the summer solstice.
7. *Āśreṣa* or *Āśleṣā*, 'embracer', represents δ, ε, ζ Hydrae.
8. *Maghā*, 'the bounties', is the group of stars near Regulus, namely α, η, γ, ζ, μ, ε Leonis.

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9. *Pūrvā Phālgunī*, 'bright', δ and θ Leonis.
10. *Uttarā Phālgunī*, 'bright', β and 93 Leonis. Since Maghavan and Phalgun are names of Indra, clearly a shifting of the summer solstice due to precession is indicated.
11. *Hasta*, 'hand'. The stars δ, γ, ε, α, β in Corvus.
12. *Citrā*, 'bright'. This is Spica or α Virginis.
13. *Svātī*, 'self-bound', or *Niṣṭyā*, is the Arctutus or α Bootis. The name appears to refer to its nearness to the Saptarṣi, Ursa Major.
14. *Viśākhā*, 'without branches'. The stars α, β, σ Librae. The name refers to the way the ecliptic separates β and σ, with the three stars looking like a bow. In the Atharvaveda, we encounter the expression *radho viśākhe*, Viśākhā are prosperity.
15. *Anurādhā*, 'propitious', 'what follows Rādhā'. These are the β, δ, π Scorpii.
16. *Rohiṇī*, 'ruddy', or *Jyeṣṭha*, 'eldest'. This is Antares, α Scorpii.
17. *Vicṛtau*, 'the two releasers', or *Mūla*, 'root'. These are the stars from ε to λ, ν Scorpii.
18. *Pūrva Āṣāḍhā*, 'unconquered', δ, ε Sagittarii.
19. *Uttarā Āṣāḍhā*, 'unconquered', σ, ζ Sagittarii.
20. *Abhijit*, 'reaching victory'. The name refers to a satisfactory completion of the system of nakṣatras. The star is Vega, the brilliant α Lyrae. This is the star that does not occur in the lists which have only 27 nakṣatras on it.
21. *Śroṇā*, 'lame', or *Śravaṇa*, 'ear'. This represents Altair, α Aquillae, with β below it and γ above it.
22. *Śraviṣṭhā*, 'most famous'. It is the diamond-shaped group α, β, δ, γ Delphini. It was later called *Dhaniṣṭhā*, 'most wealthy'. Perhaps the diamond shape gave the name. Vedāṅga Jyotiṣa says that the winter solstice was in the beginning of Śraviṣṭhā, which indicates a period of around 1350 BC.
23. *Śatabhiṣaj*, 'having a hundred physicians' is λ Aquarii and the stars around it.
24. *Proṣṭhapadā*, 'feet of stool', are the α, β Pegasi.
25. *Uttare Proṣṭhapadā*, 'feet of stool', and later *Bhadrapadā*, 'auspicious feet'. These are γ Pegasi and α Andromedae. The name of this and the preceding constellation is suggested by the large square made by these four stars.
26. *Revatī*, 'wealthy', η, α Piscium.
27. *Aśvayujau*, 'the two horse-harnessers', are the stars β and α Arietis. *Aśvinī* is a later name. The name refers to the time when these stars rose just before the sun during the vernal equinox.
28. *Apabharaṇī*, 'the bearers', are the 35, 39, 41 Arietis.

Abhijit, the twentieth in the above list, does not occur in the list of 27 in Taittirīya Saṁhitā or in Vedāṅga Jyotiṣa. Maitrāyaṇī and Kāṭhaka Saṁhitās and Atharvaveda contain lists with the 28 nakṣatras.

When the asterisms Kṛttikā and Viśākhā defined the spring and the autumn equinoxes, the asterisms Maghā and Śraviṣṭhā defined the summer and the winter solstices.

It has been suggested that because the original list of 27 nakṣatras contains only 24 distinct names, these represent the 24 half months of the year. Later, as astronomy developed further, the nakṣatra list was expanded to describe the motions of the moon.

2.1 *Nakṣatras and Chronology*

Motivated by the current models of the movements of prehistoric peoples, it became, by the end of the nineteenth century, fashionable in Indological circles to dismiss any early astronomical references in the Vedic literature. But since the publication of *Hamlet's Mill: An Essay on Myth and the Frame of Time*, by Georgio de Santillana and Hertha von Dechend, in 1969 it has come to be generally recognized that ancient myths encode a vast and complex body

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of astronomical knowledge.[20] The cross-checks provided by the dating of some of the Indian myths provide confirmation to the explicit astronomical evidence related to the nakṣatras that is spelt out below. Other confirmation comes from the archeological evidence summarized in this article.

The earth's axis of rotation is tipped at an angel of $23\frac{1}{2}°$ with respect to the direction of its orbital motion around the sun. This is what causes the changing seasons because the length of the day keeps on varying. The longest and the shortest days, also called summer and winter solstices, occur roughly near the 21st of June and 21st December, respectively. The date of a solstice can be marked by noting that around this date the sun appears to linger at the same extreme at dawn. The days when the days and nights are equal are called equinoxes. The two equinoxes, vernal in spring and autumnal in fall, mark the halfway points between summer and autumn. The equinoxes occur at the two intersections of the celestial equator and the ecliptic. The motion of the moon is more complex since its orbit is inclined approximately 5° to the earth's orbit around the sun, and earth's gravitation perturbs the moon in its orbit. The resultant precession completes a cycle in 18.61 years.

Due to the precession of the earth's polar axis the direction of the north pole with respect to the fixed background stars keeps on changing. The period of this precession is roughly 26,000. Polaris (α Ursae Minoris) is the Pole star now but around 3000 BC it was α Draconis which was followed later by β Ursae Minoris; in AD 14000 it will be Vega. The equinoxes and the solstices also shift with respect to the background stars. The equinoxes move along the ecliptic in a direction opposite to the yearly course of the sun (Taurus to Aries to Pisces rather than Pisces to Aries to Taurus and so on).

The vernal equinox marked an important day in the year. The sun's position among the constellations at the vernal equinox was an indication of the sate of the precessional cycle. This constellation was noted by its heliacal rising. The equinoctial sun occupies each zodiacal constellation for about 2200 years. Around 5000 BC it was in Gemini; it has moved since into Taurus, Aries, and is now in Pisces. The sun spends about $13\frac{1}{3}$ days in each nakṣatra, and the precession of the equinoxes takes them across each nakṣatra in about a 1000 years.

Thirteen and a half nakṣatras ending with Viśākhā were situated in the northern hemispheres; these were called devanakṣatras. The remaining nakṣatras ending with Bharaṇī that were in the southern hemisphere were called yamanakṣatras (yama; twin, dual). This classification in Taittirīya Brāhmaṇa (1.5.2.7) corresponds to 2300 BC.

As mentioned above, the list beginning with Kṛttika indicates that it was drawn up in the third millennium BC. The legend of the cutting off of Prajāpati's head suggests a time when the year began with Mṛgaśīraṣa in the fifth millennium BC. Scholars have also argued that a subsequent list began with Rohiṇī. This view is strengthened by the fact that there are two Rohiṇīs, separated by fourteen nakṣatras, indicating that the two marked the beginning of the two half-years.

The Śatapatha Brāhmaṇa speaks[21] of a marriage between the Seven Sages, the stars of the Ursa Major, and the Kṛttikās; this is elaborated in the Purāṇas where it is stated that the ṛṣis remain for a hundred years in each nakṣatra. In other words, during the earliest times in India there existed a centennial calendar with a cycle of 2,700 years. Called the Saptarṣi calendar, it is still in use in several parts of India. Its current beginning is taken to be 3076 BC. On the other hand, notices by the Greek historians Pliny and Arrian suggest that, during the Mauryan times, the calendar used in India began in 6676 BC. It is very likely that this calendar was the Saptarṣi calendar with a beginning at 6676 BC.[22]

Around AD 500 a major review of the Indian calendar was attempted by astronomers. Āryabhaṭa, Varāhamihira and others used the nakṣatra reference that the Saptarṣi were in Maghā at the time of the Mahābhārata war to determine its epoch. Āryabhaṭa declared the war

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to have occurred in 3137 BC (the Kaliyuga era begins 35 years after the war), and Varāhamihira assigned it 2449 BC. It has been suggested that this discrepancy arose because the change in the number of nakṣatras from the earlier counts of 27 to the later 28 was differently computed by the two astronomers. It is quite likely that the fame of the Kaliyuga era with its beginning assigned to 3102 BC prompted a change in the beginning of the Saptarṣi era to about the same time, viz. to 3076 BC.

The shifting of seasons through the year and the shifting of the northern axis allow us to date several other statements in the books.[23] Thus the Śatapatha Brāhmaṇa (2.1.2.3) has a statement that points to an earlier epoch where it is stated that Kṛttikā never swerve from the east. This corresponds to 2950 BC.

Maitrāyaṇīya Brāhmaṇa Upanisad (6.14) refers to the winter solstice being at the mid-point of the Śraviṣṭhā segment and the summer solstice the beginning of Maghā. This indicates 1660 BC.

Vedāṅga Jyotiṣa (Yajur 6-8) mentions that winter solstice was at the beginning of Śramisthā and the summer solstice at the mid-point of Aśleṣā. This corresponds to about 1370 BC.

It should be noted that these dates can only be considered to be very approximate. Furthermore, these dates do not imply that the texts come from the corresponding period; the text may recall an old tradition. A chronology of the Vedic period by means of astronomical references was attempted by the historian of science P.C. Sengupta.[24] Amongst other evidence, Sengupta uses the description of the solar eclipse in *RV* 5.40.5-9 to fix a date for it. Unfortunately, this work has not received the attention it deserves.

The changes in the beginning of the Nakṣatra lists bring us down to the Common Era; at the time of Varāhamihira (AD 550) the vernal equinox was in Aśvinī.

3. RITUAL, GEOMETRY AND ASTRONOMY

We have mentioned that the altars used in the ritual were based on astronomical numbers related to the reconciliation of the lunar and solar years. The fire altars symbolized the universe and there were three types of altars representing the earth, the space and the sky. The altar for the earth was drawn as circular whereas the sky (or heaven) altar was drawn as square. The geometric problems of circulature of a square and that of squaring a circle are a result of equating the earth and the sky altars. As we know, these problems are among the earliest considered in ancient geometry.

The fire altars were surrounded by 360 enclosing stones, of these 21 were around the earth altar, 78 around the space altar and 261 around the sky altar. In other words, the earth, the space, and the sky are symbolically assigned the numbers 21, 78 and 261. Considering the earth/cosmos dichotomy, the two numbers are 21 and 339 since cosmos includes the space and the sky.

The main altar was built in five layers. The basic square shape was modified to several forms, such as falcon and turtle (Fig. 2). These altars were built in five layers, of a thousand bricks of specified shapes. The construction of these altars required the solution to several geometric and algebraic problems.

Two different kinds of bricks were used: the special and the ordinary. The total number of the special bricks used was 396, explained as 360 days, of the year and the additional 36 days of the intercalary month. By layers,[25] the first has 98, the second has 41, the third has 71, the fourth has 47 and the fifth has 138. The sum of the bricks in the fourth and the fifth layers equals 186 tithis of the half-year. The number of bricks in the third and the fourth layer equals

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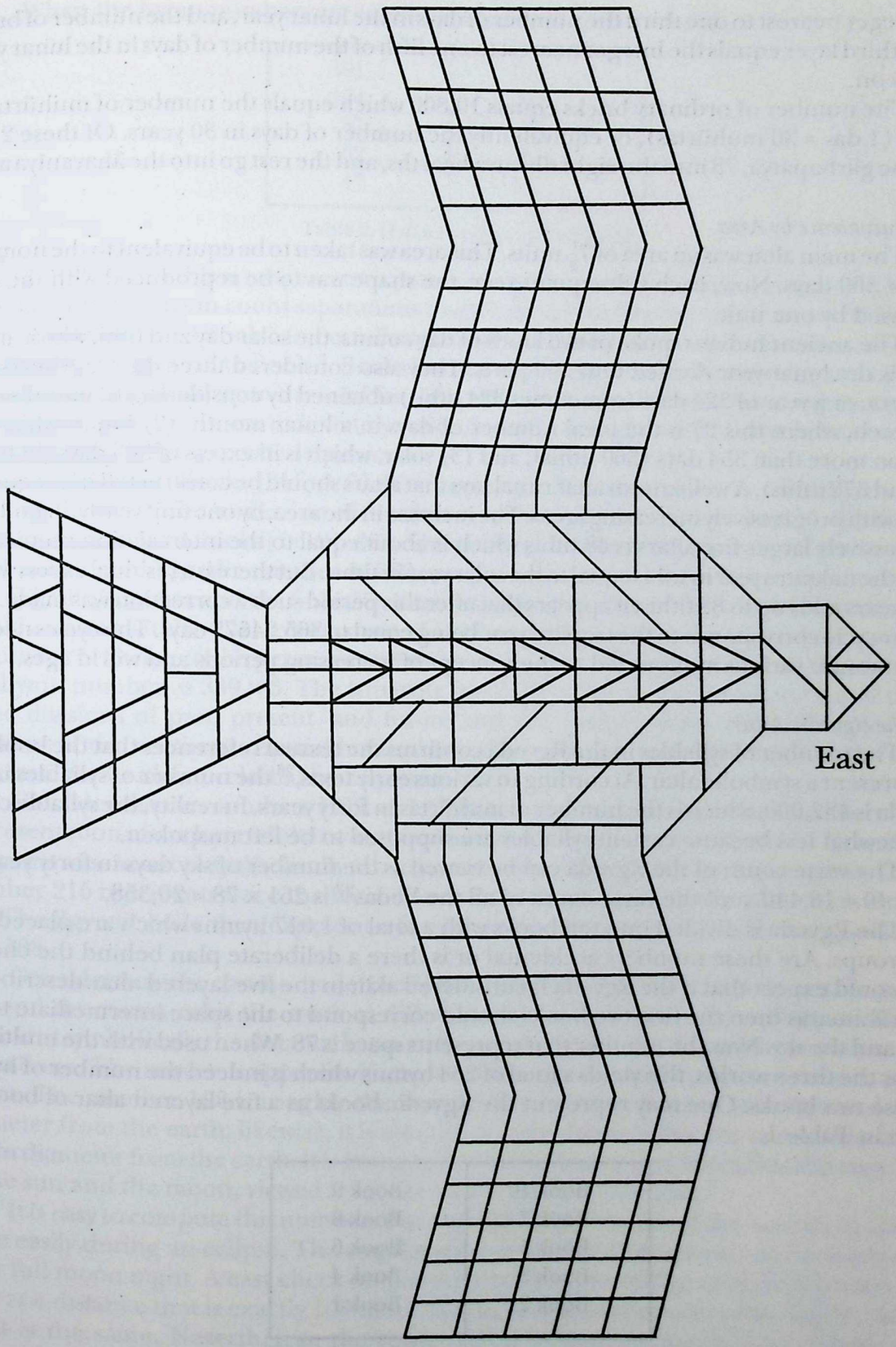

Fig. 2: A variant of Śyenacit, the falcon altar.

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the integer nearest to one third the number of days in the lunar year, and the number of bricks in the third layer equals the integer nearest to one fifth of the number of days in the lunar year, and so on.

The number of ordinary bricks equals 10,800 which equals the number of muhūrtas in a year (1 day = 30 muhūrtas), or equivalently the number of days in 30 years. Of these 21 go into the gārhapatya, 78 into the eight dhiṣṇya hearths, and the rest go into the āhavanīya altar.

3.1 *Equivalence by Area*

The main altar was an area of $7\frac{1}{2}$ units. This area was taken to be equivalent to the nominal year of 360 days. Now, each subsequent year, the shape was to be reproduced with the area increased by one unit.

The ancient Indians spoke of two kinds of day counts: the solar day and tithi, whose mean value is the lunar year divided into 360 parts. They also considered three different years: (1) nakṣatra, or a year of 324 days (sometimes 324 tithis) obtained by considering 12 months of 27 days each, where this 27 is the ideal number of days in a lunar month; (2) lunar, which is a fraction more than 354 days (360 tithis); and (3) solar, which is in excess of 365 days (between 371 and 372 tithis). A well-known altar ritual says that altars should be constructed in a sequence of 95, with progressively increasing areas. The increase in the area, by one unit yearly, in building progressively larger fire altars is 48 tithis which is about equal to the intercalation required to make the nakṣatra year in tithis equal to the solar year in tithis. But there is a residual excess which in 95 years adds up to 89 tithis; it appears that after this period such a correction was made. The 95 year cycle corresponds to the tropical year being equal to 365.24675 days. The cycles needed to harmonize various motions led to the concept of increasing periods and world ages.

3.2 *The Ṛgvedic Altar*

The number of syllables in the Ṛgveda confirms the textual references that the book was to represent a symbolic altar. According to various early texts,[26] the number of syllables in the Ṛgveda is 432,000, which is the number of muhūrtas in forty years. In reality, the syllable count is somewhat less because certain syllables are supposed to be left unspoken.

The verse count of the Ṛgveda can be viewed as the number of sky days in forty years or $261 \times 40 = 10{,}440$, and the verse count of all the Vedas[27] is $261 \times 78 = 20{,}358$.

The Ṛgveda is divided into ten books with a total of 1,017 hymns which are placed into 216 groups. Are these numbers accidental or is there a deliberate plan behind the choice? One would expect that if the Ṛgveda is considered akin to the five-layered altar described in the Brāhmaṇas then the first two books should correspond to the space intermediate to the earth and the sky. Now the number that represents space is 78. When used with the multiplier of 3 for the three worlds, this yields a total of 234 hymns which is indeed the number of hymns in these two books. One may represent the Ṛgvedic books as a five-layered altar of books as shown in Table 1.

Book 10	Book 9
Book 7	Book 8
Book 5	Book 6
Book 3	Book 4
Book 2	Book 1

Table 1: The Altar of Books

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When the hymn numbers are used in this altar of books we obtain Table 2.

191	114
104	92
87	75
62	58
43	191

Table 2: Hymns in the Altar of Books

The choice of this arrangement is prompted by the considerable regularity in the hymn counts. Thus the hymn count separations diagonally across the two columns are 29 each for Book 4 to Book 5 and Book 6 to Book 7 and they are 17 each for the second column for Book 4 to Book 6 and Book 6 to Book 8. Books 5 and 7 in the first column are also separated by 17; Books 5 and 7 also add up to the total for either Book 1 or Book 10. Another regularity is that the middle three layers are indexed by order from left to right whereas the bottom and the top layers are in the opposite sequence.

Furthermore, Books [4+6+8+9]=339, and these books may be taken to represent the spine of the altar. The underside of the altar now consists of the Books [2+3+5+7]=296, and the feet and the head Books [1+10]=382. The numbers 296 and 382 are each 43 removed from the fundamental Ṛgvedic number of 339.

The Brāhmaṇas and the Śulbasūtra tell us about the altar of chandas and metres, so we would expect that the total hymn count of 1017 and the group count of 216 have particular significance. Owing to the pervasive tripartite ideology of the Vedic books we choose to view the hymn number as 339 × 3. The tripartite ideology refers to the consideration of time in three divisions of past, present, and future and the consideration of space in the three divisions of the northern celestial hemisphere, the plane that is at right angle to the earth's axis, and the southern celestial hemisphere.

Consider the two numbers 1017 and 216. One can argue that another parallel with the representation of the layered altar was at work in the group total of 216. Since the Ṛgvedic altar of hymns was meant to symbolically take one to the sky, the abode of gods, it appears that the number 216 represents twice the basic distance of 108 taken to separate the earth from the sky. The Ṛgvedic code then expresses a fundamental connection between the numbers 339 and 108.

Consider now the cosmic model used by the ancients. The earth is at the center, and the sun and the moon orbit the earth at different distances. If the number 108 was taken to represent symbolically the distance between the earth and the sky, the question arises as to why it was done. The answer is apparent if one considers the actual distances of the sun and the moon. The number 108 is roughly the average distance that the sun is in terms of its own diameter from the earth; likewise, it is also the average distance that the moon is in terms of is own diameter from the earth. It is owing to this marvellous coincidence that the angular size of the sun and the moon, viewed from the earth, is about identical.

It is easy to compute this number. The angular measurement of the sun can be obtained quite easily during an eclipse. The angular measurement of the moon can be made on any clear full moon night. A easy check on this measurement would be to make a person hold a pole at a distance that is exactly 108 times its length and confirm that the angular measurement is the same. Nevertheless, the computation of this number would require careful observations. Note that 108 is an average and due to the ellipticity of the orbits of the earth and the moon the distances vary with the seasons. It is likely, therefore, that observations did not lead to the precise number 108, but it was chosen as the true value of the distance since it is equal to 27 × 4, because of the mapping of the sky into 27 nakṣatras.

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The second number 339 is simply the number of disks of the sun or the moon to measure the path across the sky: $\pi \times 108 \approx 339$.

We return to a further examination of the numbers 296, 339 and 382 in the design of the Ṛgvedic altar. It has been suggested that 339 has obvious significance as the number of sun-steps during the average day or the equinox and the other numbers are likely to have a similar significance. In other words, 296 is the number of sun-steps during the winter solstice and 382 is the number of sun-steps during the summer solstice.

There also exists compelling evidence, of a probabilistic sense, that the periods of the planets had been obtained and used in the setting up of the Ṛgvedic astronomical code.[28]

4. THE MOTION OF THE SUN AND THE MOON

Vedāṅga Jyotiṣa (*VJ*), the text that describes some of the astronomical knowledge of the times of altar ritual, has an internal date of *c.* 1350 BC obtained from its assertion that the winter solstice was at the asterism Śraviṣṭhā (Delphini). Recent archaeological discoveries support such an early date, and so this book assumes great importance in the understanding of the earliest astronomy.

VJ describes the mean motions of the sun and the moon. This manual is available in two recensions: the earlier Ṛgvedic *VJ* (*RVJ*) an the later Yajurvedic *VJ* (*YVJ*). *RVJ* has 36 verses and *YVJ* has 43 verses. As the only extant astronomical text from the Vedic period, we describe its contents in some detail,

The measures of time used in *VJ* are as follows:

1 Lunar year	=	360 tithis
1 solar year	=	366 solar days
1 day	=	30 muhūrtas
1 muhūrtas	=	2 nāḍikās
1 nāḍikā	=	$10\frac{1}{20}$ kalās
1 day	=	124 aṁśas (parts)
1 day	=	603 kalās

Furthermore, five years were taken to equal a yuga. A ordinary yuga consisted of 1,830 days. An intercalary month was added at half the yuga and another at the end of the yuga.

What are the reasons for the use of a time division of the day into 603 Kalās? This is explained by the assertion[29] that the moon travels through 1,809 nakṣatras in a yuga. Thus the moon travels through one nakṣatra in $1\frac{7}{603}$ sidereal days because

$$1{,}809 \times 1\frac{7}{603} = 1{,}830.$$

Or the moon travels through one nakṣatra in 610 kalās. Also note that 603 has 67, the number of sidereal months in a yuga, as a factor. The further division of a kalā into 124 kāṣṭhās was in symmetry with the divisions of a yuga into 62 synodic months or 124 fortnights (of 15 tithis), or parvans. A *parvan* is the angular distance traveled by the sun from a full moon to a new moon or vice versa.

The ecliptic was divided into twenty seven equal parts, each represented by a nakṣatra or constellation. The *VJ* system is a coordinate system for the sun and the moon in terms of the 27 nakṣatras. Several rules are given so that a specific tithi and nakṣatra can be readily computed.

The number of risings of the asterim Śraviṣṭhā in the yuga is the number of days plus five (1830+5=1835). The number of risings of the moon is the days minus 62 (1830–

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62=1768). The total of each of the moon's 27 asterisms coming around 67 times in the yuga equals the number of days minus 21 (1830–21=1809).

The moon is conjoined with each asterism 67 times during a yuga. The sun stays in each asterism $13\frac{5}{9}$ days.

The explanations are straightforward. The sidereal risings equals the 1,830 days together with the five solar cycles. The lunar cycles equal the 62 synodic months plus the five solar cycles. The moon's risings equal the risings of Śraviṣṭhā minus the moon's cycles.

This indicates that the moon was taken to rise at a mean rate of $\frac{1,830}{1,768}$ =24 hours and 50.4864 minutes.

4.1 *Computation of Tithis, Nakṣatras, Kalās*

Although a mean tithi is obtained by considering the lunar year to equal 360 tithis, the determination of a tithi each day is by a calculation of a shift of the moon by 12° with respect to the sun. In other words, in 30 tithis it will cover the full circle of 360°. But the shift of 12° is in an irregular manner and the duration of the tithi can vary from day to day. As a practical method a mean tithi is defined by a formula. *VJ* takes it to be 122 parts of the day divided into 124 parts.

Each yuga was taken to begin with the asterism Śraviṣṭhā and the synodic month of Māgha, the solar month Tapas and the bright fortnight (parvan), and the northward course of the sun and the moon. The intercalary months were used in a yuga. But since the civil year was 366 days, or 372 tithis, it was necessary to do further corrections. As shown in the earlier section, a further correction was performed at 95 year, perhaps at multiples of 19 years.

The day of the lunar month corresponds to the tithi at sunrise. A tithi can be lost whenever it begins and ends between one sunrise and the next. Thus using such a mean system, the days of the month can vary in length.

4.2 *Accuracy*

There are other rules of a similar nature which are based on the use of congruences. These include rules on hour angle of nakṣatras, time of the day at the end of a tithi, time at the beginning of nakṣatra, correction for the sidereal day, and so on. But it is clear that the use of mean motions can lead to discrepancies that need to be corrected at the end of the yuga.

The framework of *VJ* has approximations built into it such as consideration of the civil year to be 366 days and the consideration of a tithi as being equal to $\frac{122}{124}$ of a day. The error between the modern value of tithi and its *VJ* value is:

$$\frac{354.367}{360} - \frac{122}{124}$$

which is as small as 5×10^{-4}. This leads to an error of less than a day in a yuga of five years.

The constructions of the geometric altars as well as the Vedic books that come centuries before *VJ* confirm that the Vedic Indians knew that the year was more than 365 days and less than 366 days. The five year period of 1,830 days, rather than the more accurate 1,826 days, was chosen because it is divisible by 61. This choice defines a symmetry with the definition of the tithi as $\frac{61}{62}$ of the day. The *VJ* system was thus very accurate for the motions of the moon but it could have only served as a framework for the motions of the sun. It appears that there were other rules of missing days that brought the calendar into consonance with the reality of the nakṣatras at the end of the five year yuga and at the end of the 95 year cycle of altar construction.

Mean motion astronomy can lead to significant discrepancy between true and computed values. The system of intercalary months introduced further irregularity into the system. This

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means that the conjunction between the sun and the moon that was assumed at the beginning of each yuga became more and more out of joint until such time that the major extra-yuga corrections were made.

Since the Vedic astronomers were evidently aware of the many corrections that are required in the calendric system of the *VJ*, one might wonder about the choice of its constants. As explained before the yuga of 1,830 days, rather than the more accurate 1,826 days, was chosen because it is divisible by 61; this choice simplifies computations for a tithi defined as $\frac{61}{62}$ of the day.

5. THE PLANETS

The Ṛgveda and the Śatapatha Brāhmaṇa speak of the five planets as gods.[30] There is also a mention of the thirty-four lights, which appear to be the twenty seven nakṣatras, the five planets, the sun and the moon. The moon is the fastest moving of the heavenly bodies, and so it is compared to the male who activates or fertilizes the other heavenly bodies with which it comes in contact. The Ṛgveda speaks of the five bulls of heaven, which appear to be the five planets. Being faster than the fixed stars, the planets can, in turn, be compared to bulls.

Taittirīya Saṁhitā[31] speaks of the 33 daughters of Prajāpati, personification of time here, that are given in marriage to Soma the moon, viewed as king. These are the 27 nakṣatras, the five planets, and the sun. The sun as the bride, Sūrya, is described in the Ṛgveda and the Atharvaveda.

Since the planets move through the nakṣatras and Venus and Jupiter are brighter than any of the stars, observation of the nakṣatras presupposes a notice of the planets. The Vedāṅga Jyotiṣa does not mention the planets, but that is so because its concern is only the motions of the sun and the moon related to fixing the calendar.

The rivalry between the families of Aṅgirases and the Bhṛgus, mythical figures in the Ṛgveda, represents the motions of Jupiter and Venus. This is clear in later accounts where Bṛhaspati (Jupiter), the priest of the gods because its motion is closest to the ecliptic, is an Aṅgiras and Kavi Uśanas or Śukra (Venus), a Bhārgava, is the priest of the Asuras.

The idea of eclipse was expressed by the notion of Rahu seizing the heavenly body. The fact that graha, 'seize,' is the name used for planets right from the time of Atharvaveda[32] suggests that the waxing and waning of the two inferior planets, Mercury and Venus, as well as the change in the intensity of the others, was known.

Although there is mention of a week of six days, called a ṣaḍaha, in the early books, it does not follow that the tradition of a week of seven days is a later one. The seven day week was in use during the time of Atharva Jyotiṣa. The days were named after Āditya (Sun), Soma (Moon), Bhauma (the son of Earth, Mars), Budha (Mercury), Bṛhaspati (Jupiter), Bhārgava (the son of Bhṛgu, Venus), and Śanaiścara (the slow-moving planet, Saturn).

The sidereal periods suggested by the astronomical code in the organization of the Ṛgveda are:[33]

Mercury	:	87 days
Venus	:	225 days
Mars	:	687 days
Jupiter	:	4,350 days
Saturn	:	10,816 days.

5.1 *Soma*

Soma, or the moon, is one of the most important deities of the Ṛgveda. It is related to Sūrya the way puruṣa is related to prakṛti. Soma is almost always the moon in the ninth book

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of the Ṛgveda. That very few Western scholars of the nineteenth century recognized this fact can only be explained by recalling the incorrect assumptions they laboured under. Soma, as a drink, was meant to celebrate the creative function of the moon as reflected in the tides, the menstrual cycle and the growth of plants.

6. THE YUGA CONCEPT

There are allusions to yugas, meant as an age, in the Vedas. In the Aitareya Brāhmaṇa,[34] Kali, Dvāpara, Tretā, and Kṛta are compared to a man lying down, moving, rising, and walking. Ṣaḍviṁśa Brāhmaṇa[35] mentions the four ages Puṣya, Dvāpara, Khārvā, and Kṛta. In order from Kṛta to Kali, each yuga represents a decline in morality, piety, strength, knowledge, truthfulness, and happiness. The notion of a yuga appears to have a historical basis. If we accept that a catastrophic tectonic event took place around 1900 BC, leading eventually to a great shift in the population away from the Sarasvatī valleys, then Kaliyuga could be a memory of the beginning of that dark age. Support for this view comes from the Mahābhārata, according to which all places were sacred in the Kṛtayuga; Puṣkara in the Sarasvatī region was the most sacred in Tretāyuga; Kurukṣetra in Dvāpara; and Prayāga at the junction of Gaṅgā and Yamunā in the Kaliyuga. This clearly marks the shift in focus of the Vedic people.

The five years of the yuga of the Vedāṅga Jyotiṣa are named variously; one text calling them saṁvatsara, parivatsara, idāvatsara, iduvatsara, and vatsara. It has been suggested that the 33 gods mentioned at many places refer to a cycle of 33 years but this cannot be accepted until corroborative evidence is found. As mentioned before, a cycle of 95 years is described in the Śatapatha Brāhmaṇa. The yuga of 60 years appears to have emerged out of an attempt to harmonize the approximate sidereal periods of 12 and 30 years for Jupiter and Saturn, respectively. Consideration of more accurate sidereal value requires much larger periods that are seen in the later Siddhāntic astronomy of the Classical period.[36]

The Purāṇas talk of a kalpa, a day of Brahmā which is taken to equal 12,000 thousands of divine years, each of which equals 360 human years, for a total of 4,320 million human years. Kṛta, Tretā, Dvāpara, and Kali are supposed to last 4,000, 3,000, 2,000, 1,000 divine years respectively. In addition, there are sandhyās (twilights) of 800 (two twilights of 400 years), 600, 400, 200 on the yugas, in order, to give a total span of 12,000 divine years. Brahmā, the creator of time, is a personification of the beginning of the sustaining principle, to be taken either as Viṣṇu or Śiva. Each day of Brahmā is followed by a night of the same duration. A year of Brahmā equals such 360 days and nights, and the duration of the universe is the span of 100 Brahmā years. The largest cycle is 311,040,000 million years. We are supposed to be in the 55th year of the current Brahmā. The large cycle is nested in still larger cycles. Within each kalpa are fourteen secondary cycles, called manvantaras, each lasting 306,720,000 years. In each manvantara humans begin with a new Manu. We are now in the seventh manvantara of the kalpa, started by Manu Vaivasvata.

A kalpa equals a thousand mahāyugas, each of which has the four yugas Kṛta, Tretā, Dvāpara, and Kali. Each manvantara may be divided into 71 mahāyugas. While the yugas, as defined in the Purāṇic literature of the first millennium AD have extremely large periods in multiples of the 'years of the gods', it is likely that the four yugas were originally 4,800, 3,600, 2,400, and 1,200 ordinary years, respectively.

7. PHYSICS, PSYCHOLOGY, MEDICINE

Once one sees that the Vedic knowledge was defined in a recursive fashion, it becomes easy to see Vedānta, tantra and yoga, as well as Vedic ritual as different aspects of this system. One

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noteworthy equivalence is between the 72,000 nāḍīs in the human body and one third the number of muhūrtas in twenty years; another is that of the 21 organs in the middle body and the number signifying the earth. At other times the equivalences were more metaphorical. The eyes are the sun and the moon, likewise one can speak of the planets (graha) inside the body; nevertheless, here a numerical connection in terms of planet periods and body processes might have been meant.

One may speculate that the catastrophe of the drying up of the Sarasvatī river was such a major disruption so that the system of knowledge representation using altar designs fell into disuse. This is supported by the fact that the altars required an urban setting owing to the need of precise bricks of different sizes. The transition from the erstwhile urban to the new rural settings in the newly settled regions to the east beyond the Gaṅgā is represented by the Āraṇyaka phase of the Vedic literature and it is also alluded to in the Brāhmaṇas. It was during this phase that the altar ritual lost its link with astronomy and was transformed. Thus agnihotra was replaced by prāṇa-agnihotra. Later developments focused on the inner space of the individual. The fires of the altar have the parallel in the fires inside the body. A sacrifice, yajña, is a recursive system; any given level is based on a transcendence of the lower level. This is to be seen not only in life but also within the mind, which was viewed as a hierarchical system with systems of the gross body, prāṇa, manas, vijñāna, and ānanda.

In analysis a dynamic balance between three fundamental categories was postulated. Śvetāśvatara Upaniṣad[37] speaks of a balance between red, white, and black made conscious by puruṣa; this is repeated in the rajas, sattva, and tamas of prakṛti in Sāṅkhya. Clearly, the regions of atmosphere, sky, and earth correspond to these three. In Vedic society also there is mention of an original single class that divided into the three brāhmaṇa, rājanya, and vaiśya. The altars are made in five layers to represent the three regions and the two intermediate spaces where atmosphere and earth and also atmosphere and sky meet. Paralleling this later a fourth class of śūdra was added to the societal classes to represent the new 'foundation' against which the other classes were defined; the fifth class of 'sages', who transcended class categories, was described only indirectly. The texts themselves do not speak with this directness about the parallels but these are easy enough to infer.

Bṛhadāraṇyaka Upaniṣad[38] speaks of three primary constituents. Later like the expansion of the altar from three to five layers, we come across five primary elements, pañcabhūtas, earth, water, fire, air, and ether. The three doṣas or dhātus (humors) vāta, pitta, and kapha in the human body likewise define a basic tripartite model. But each of these dhātus is taken to have five types.

The observer has a central place in Indian thought, and a consideration of the act of observation leads to the question of the nature of time. This question eventually leads to a consideration of consciousness and the self. But as the basic science of time, astronomy helps us place the overarching system of knowledge of Vedic times in context.

ABBREVIATIONS

AB	Aitareya Brāhmaṇa
ASS	Āpastamba Śulbasūtra
AV	Atharvaveda
BSS	Baudhāyana Śulbasūtra
BU	Bṛhadāraṇyaka Upaniṣad
CU	Chāndogya Upaniṣad
KB	Kauṣītaki Brāhmaṇa
PB	Pañcaviṁśa Brāhmaṇa
RV	Ṛgveda
ŚB	Śatapatha Brāhmaṇa
ŚU	Śvetāśvatara Upaniṣad
TB	Taittirīya Brāhmaṇa
TS	Taittirīya Saṁhitā
VJ	Vedāṅga Jyotiṣa

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1. See for example, *RV* 1.25.8. This is described in many passages in other text such as Kauṣītaki Brāhmaṇa and Śatapatha Brāhmaṇa. Specifically the thirteenth intercalary month is mentioned in *KB* 5.8, 7.10, 19.2, 25.11 and *ŚB* 5.4.5.23, 6.2.2.29, 9.1.1.43, 12.8.2.31. For detailed references and a general background to this article see S.C. Kak, *The Astronomical Code of the* Ṛgveda, Aditya, New Delhi, 1994.
2. *RV* 1.164.45.
3. *ŚB* 11.5.8 or *AB* 5.32.
4. Although such a technical usage of psychological categories comes later in Sāṅkhya, references in *CU* 6.4 and *ŚU* 4.5 make it abundantly clear that these categories are quite old.
5. S.C. Kak, 'Astronomy of the Vedic Altars and the Ṛgveda', *Mankind quarterly*, 33, 43-55, 1992; S.C.Kak, 'Astronomy of the Vedic Altars', *Vistas in Astronomy*, 36, 117-40, 1993; and so on. For a detailed bibliography see S.C. Kak, *The Astronomical Code of the* Ṛgveda.
6. *RV* 1.164.2 speaks of *eko aśvo vahati saptanāmā*; Nirukta 4.27 makes it clear that this horse is the sun; *ŚB* 6.1.11 speaks of the birth from Prajāpati, representing time here, of aśva before that of the earth.
7. *BSS* 7.17, *ASS* 14.11. For the text see S.N. Sen and A.K. Bag, *The Śulbasūtras*. Indian National Science Academy, New Delhi, 1983. The significance of its mathematics is described in A. Seidenberg, 'The origin of mathematics', *Archive for History of Exact Sciences*, 18, 301-42, 1978.
8. J.Gonda, *The Ritual Sūtras*. Otto Harrassowitz, Wiesbaden, 1977. That the ritual had its own grammar is described in F. Staal, *Rules Without Meaning: Ritual, Mantras and the Human Sciences*, Peter Lang, New York, 1989.
9. *ŚB* 10.4.3.9.
10. *ŚB* 7.1.1.13 for earth, *ŚB* 7.1.2.12 for space, and *ŚB* 8.2.1,2 for sky or heaven.
11. F.E. Pargiter, *Ancient Indian Historical Tradition*, Oxford University Press, London, 1922.
12. B.G. Tilak, *The Orion*, Tilak Brothers, Pune, 1893; M. Winternitz, *A History of Indian Literature*, University of Calcutta, 1927; reprint Delhi, 1972.
13. S.C. Kak, 'The Indus Tradition and the Indo-Aryans', *Mankind Quarterly*, 32, 195-213, 1992; J.G. Shaffer, 'The Indus Valley, Baluchistan, and Helmand Traditions: Neolithic through Bronze Age', in J. Ehrlich (ed.), *Chronologies in Old World Archaeology*, 3rd Edition, Chicago University Press, Chicago, 1992. See also G. Feuerstein, S.C. Kak and D. Frawley, *In Search of the Cradle of Civilization: New Light on Ancient India*, Quest Books, Wheaton, IL, 1995. See also S.C. Kak, 'Archaeo-astronomy and Literature', *Current Science*, 73, 1997, pp. 624-7.
14. H.P. Francfort, 'Evidence for Harappan Irrigation System in Haryana and Rajasthan', *Eastern Anthropologist*, 45, 87-103, 1992.
15. *PB* 25.10.16. This also fixes this Brāhmaṇa as posterior to 1900 BC.
16. Some scholars have contested the identification of Vena with Venus.
17. *ŚB* 2.1.2.18-19; see also Nirukta 3.20.
18. V. Vidyālaṅkāra, Śatapatha Brāhmaṇa*stha Agnicayana Samīkṣā*, Bahalgarh, 1985.
19. *TB* 1.5.2.7.
20. G. de Santillana and H. von Dechend, *Hamlet's Mill: An essay on Myth and the Frame of Time*, Gambit, Boston, 1969.
21. *ŚB* 2.1.2.4-5.
22. S.C. Kak, *The Astronomical Code of the* Ṛgveda.
23. T.S. Kuppanna Sastry, *Vedāṅga Jyotiṣa of Lagadha*, Indian National Science Academy, New Delhi, 1985.
24. P.C. Sengupta, *Ancient Indian Chronology*, University of Calcutta Press, Calcutta, 1947.
25. *ŚB* 10.4.3.14-20.
26. *ŚB* 10.4.2.23-24.
27. S.P. Sarasvati and S. Vidyalankara, Ṛgveda *Saṁhitā*, Veda Pratishthana, Delhi, 1987.
28. S.C. Kak, *The Astronomical Code of the* Ṛgveda.
29. T.S. Kuppanna Sastry, *Vedāṅga Jyotiṣa of Lagadha*. See also S.C. Kak, 'The Astronomy of the Age of Geometric Altars', *Quarterly Journal of the Royal Astronomical Society*, 36, 1995 pp. 385-96.
30. *RV* 4.50.4, 10.123.1; *ŚB* 4.2.1.
31. *TS* 2.3.5.
32. *AV* 19.9.7-10.
33. S.C. Kak, 'The Astronomical Code of the Ṛgveda', *Current Science*, 66, 323-6, 1994. See also S.C. Kak, 'Knowledge of Planets in the Third Millenium BC', Quartely Journal of the Royal Astronomical Society, 37, 1996, pp. 705-15.

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34. *AB* 7.15.4.
35. *ṢB* 5.6.
36. R. Billard, *L'astronomie Indienne,* Paris, 1971.
37. *ŚU* 4.5.
38. *BU* 1.2.2.

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SECTION VI

FOUNDATIONS AND BEGINNINGS OF SYSTEMATIC SCIENCE

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CHAPTER XXIV

Vedic Technology

Prem Sagar Chaturvedi

The study of the 'technology' of primitive times, has been devoted exclusively to the role of *homo technicus*, 'manufacturing man', also called *homo faber*, 'fabricating man'. The material remains of his technological actions discovered in the form of lithic, ceramic and metallic artifacts and otherwise are subjected to study through the method of science, suited for the study of the world of nature. The historian, more precisely the prehistorian, has to fall back on his ingeniousness to interpret the values involved in the material remains and, in the process, is constrained to introduce into the picture his own concepts, prejudices and understanding. The world of primitive man thus created belongs partly to primitive man and partly to the prehistorian. It is built, on the one hand, by the artifacts of primitive man and, on the other, by interpretations based on the inferences of modern man. This has resulted in an ambivalence, as it gives only a pseudoscopic vision of the early man.

This exclusive reliance by the prehistorians on archaeological data is based on the belief that linguistic data for the remote ancient periods are not available. To us, this is simply uncalled for because there is every possibility that *homo faber*, fabricating man, was also *homo vocalis*, speaking man. These are, in fact, the two major aspects of *homo sapiens* which are interrelated and essentially complementary. The *homo vocalis* aspect is dependent on *homo faber* for his expression in action. Likewise, the *homo faber* aspect relies heavily on *homo vocalis* for a true and effective interpretation of his technological actions. In fact, 'word', which is a vocalic tool, is as important as material tool. For human progress, the word *vāśī*, hand-axe, is of no less importance than the object which it represents.

It is true enough that, while the remains of *homo faber* have survived the icy fingers of destruction down the millennia, written records, which constitute the evidence of the type we call *homo vocalis*, are not available for the period ante-dating *circa* 4000 BC, but this should not be construed to mean that the word, as such, had not come into existence in those remote periods. The spoken word did exist, though its written form is not available. For us, there is hardly any distinction, for the construction of history, between the spoken word and written word, except that the script 'lingers on and the phoneme flies away'. The spoken word is indeed transitory inasmuch as the sound stays but for a moment. It may, however, be stated that this momentary-transitory word is a part of tradition which endures through oral transmission for millennia, later to be assimilated in the records of literary tradition. Now, what is required is to salvage this word of antiquity with the aid of linguistics and use its testimony to extricate the social functions and cultural values dissolved in the mute primitive artifacts. The process is extremely useful as primitive psychology gets combined with primitive archaeology in the proposed method. Unfortunately, because of various factors, technology,

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specially of the primitive period, was studied without its social and cultural dimension. In other words, *homo technicus* or, as the prehistorian calls him, *homo faber* stands in the writings and researches of prehistory without the corresponding aspect of *homo vocalis*.

We find in archaeology the acceptance of human progress based on the evidence of gradual innovation of lithic technology. This indirectly conceives a world as being determined by stone artifacts and technology. This is, however, by no means certain since it goes contrary to the data in ancient literatures. In the ancient Indo-Iranian and Greco-Roman literary traditions, we find certain glimpses which underline the importance of wood as a primary material in the life of early man. It was so much conditioned by wood that in some of the passages[1] the Ṛgveda describes in metaphorical fashion how wood is the locus (*adhiṣṭhāna*) and the primal material cause (*ārambhaṇa*) of the universe.[2] This is in full consonance with the Avestan descriptions where Ahur Mazda is conceived as a carpenter who fashions the earth (Gāus-Tašā),[3] evidently from wood. Similarly, the Greeks and Romans and some other tribes of northern Europe firmly believed that the human race originated from trees.[4] In this connection, Schrader draws our attention to the myth of the world tree, Yggdrasil, prevalent in the north of Europe and also to the primeval view that looks for the abode of the immortal gods in trees, woods and groves which are the oldest temples erected for the immortals by Nature herself.[5]

Besides this notion shared by the Indo-Aryans, Iranians and Greco-Romans, several other instances confirm the primacy of wood and woodcraft in the life of early man. Firstly, anthropological studies carried out among anthropoids have revealed that they not only subsist on leaves, fruits and shoots, but also that their basic skills have gradually been evolved in arboreal surroundings. The development of manipulative powers among these predecessors of man has been mainly confined to the medium of wood.[6] Since man, *homo-sapiens*, lived, in the beginning, in identical natural environs, he depended likewise on trees and wood more than on anything else. Secondly, a number of lithic utensils and articles, e.g. *pināka* (Greek *pinax*, staff, board or plank), *kalaśa* (Greek *kulix*, Latin *calix*, cup, goblet), *trika-druka* (such as Latin *qua-drupesu*, troughs), posts and pillars (such as *yūpa* in the Vedic tradition),[7] dwellings[8] etc., marked in archaeological and literary traditions, betray an obvious impact of wooden archetypes. Evidently, in several cases, the lithic technology came into existence by way of imitation and transformation of the dendrite or wood technology. Thirdly, the word 'technology' is a direct descendant of the Indo-European root *tek*, 'to fashion', Sanskrit *takṣ*, Avestan *taš*, Greco-Roman *technos*, Lithuanian *tašyati*, Church Slavic *tasati*, etc.[9] which signify preponderantly the carpenter's works. Likewise, the names of early technicians, such as the Sanskrit *takṣan*, Avestan *tašan* and Greco-Roman *tektōn*, which have been derived from the same Indo-European root mainly stand for a worker in wood, a carpenter, a joiner. Lastly, a survey of the root *takṣ*, 'to fashion', in the Ṛgveda, the earliest record of the Indo-Aryans, reveals that it has mostly been employed to designate woodwork. At least, nowhere does it signify stonework. All these instances convincingly demonstrate that the archetype of technology was conceived in the beginning primarily with the manufacture of wooden objects.

Before passing on to the technologies practised by the Indo-Aryans, it would be appropriate to discuss briefly the conceptual notion which they presumed to be underlying all sorts of creative skills. To them, it was a kind of potent mysterious power which manifests itself in creative skills of an extraordinary nature. This has been expressed by the root *viṣ*, 'to be active', and its several derivatives *viṣṭi*, *viṣṭvī*, *veṣaṇā*, *viveṣa*, *veviṣata* etc. In the Ṛgveda I.92.3, reference has been made to the wondrous action of the dawn damsels who illumine the sky and the entire firmament through their *viṣṭī*. The Ṛgveda X.117.9 makes allusion to *viviṣṭaḥ* and explains that, though both hands are equal, they are not endowed with an equal capacity to work. Evidently, it is the capacity to work or perform which has been conveyed by *viviṣṭaḥ*.

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In I.20.4, *viṣṭī* is mentioned in reference to the *Ṛbhus* who are said to have rejuvenated their old parents through their *viṣṭī* (*ṛbhavo viṣṭyakṛta*). This has further been described in the Ṛgveda IV.33.2, where it has been expressed by the term *veṣaṇā*. Sāyaṇa, who erroneously expounds the term *viṣṭī* in the earlier passage as *vyāptiyuktāḥ*, 'having pervaded', equates *veṣaṇā*, i.e. the rejuvenating of aged parents with the acts of fashioning the *camasa* (*camasa-nirmāṇādikarmabhiḥ*). It is, in fact, because of their mysterious skills that the Ṛbhus, the sons of Sudhanvan, are said to have obtained immortality.[10] A number of passages[11] in the text show that the Ṛbhus are master technicians, accredited with the fashioning of chariots for the Aśvins, multiplying a single *camasa*, a drinking bowl, fourfold, shaping armour (*aṅsastra*) for the gods, restoring the cow from the leather of a dead one, fabricating horses and riches and rejuvenating their old parents who were lying like decaying posts.

The notion of *viṣṭī*, the mysterious power of creation, finds its culmination in the concept of Viṣṇu, a prominent deity of the Vedic pantheon. Derived from the root *viṣ*, *Viṣṇu* literally means one endowed with the potency to perform action, to pervade or to enter. There is no doubt that in several passages, he emerges as a creator-god. Most exemplary among them is: *viṣṇuryonim kalpayatu tvaṣṭā rūpāṇi piṁśatu*—Viṣṇu prepares the womb and Tvaṣṭṛ adorns the forms.[12] Here both Viṣṇu (from the root *viṣ*, to be active) and Tvaṣṭṛ (from the root *tvakṣ* which is similar to *takṣ*, to fashion) are mentioned in connection with the fashioning of the world. It is being assumed that creation of multifarious facets of the world is the product of a joint venture of Viṣṇu and Tvaṣṭṛ. The former performs the foundation work by preparing the womb and the latter carves the super-structure by creating different forms. That Viṣṇu is a prime creator of the world is also evident from Ṛgveda X.15.3 where he has been invoked to help the formation of the female womb as a breeding place for children and other gods, Tvaṣṭṛ the artificer, Prajāpati the creator and Dhātar the preserver, are also urged to play their specific roles in the entire process of successful human procreation.[13]

Thus, a study of the root *viṣ* and its derivatives makes it abundantly clear that behind the works of technical skill or, as a matter of fact, all types of creation, lay a notion of a potent, mysterious power which finds expression through these skills. This acquires immense significance from the standpoint of technology as the technician is assumed to be accomplishing a sort of mysterious or divine act. The mythology of Tvaṣṭṛ, Ṛbhus and Viśvakarman eloquently expresses their immortal status on the basis of technological expertise.

The technologies practised by the Vedic people may be broadly divided into two distinct categories: the *takṣ* and the *gharma*. The *takṣ* basically depends on scraping, tearing, cutting and manipulating through addition, subtraction, duplication and multiplication for giving material the desired form whereas *gharma* applies the thermic principle, the firing technique for plasticity. Analysed materially, the *takṣ* finds expression in the dendrite or woodcraft, the dermatic or leather-craft, the textile and the lithic technologies. Likewise, the *gharma* is manifested in the ceramic and metal technologies.

1. THE *TAKṢ* TECHNOLOGY

(a) Woodcraft

Among the effects of the *takṣ* technology, dendrite or woodcraft ranks the foremost. No other craft has so prominently been sketched in the Vedic literature as this one which affirms that wood and wooden objects played an important role in the life of the Indo-Aryans.

Basic terms for wood in the Vedic literature are *dāru* and *dru*. These stem from the Indo-European (IE) words *doru* and *derwo* and are found scattered in different shapes in a number of IE dialects.[14] Taken together, these point to a long practised and widely prevalent tradition of woodworking among the Indo-Europeans.

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Uses of Wood: In the Vedic literature, *dāru* and *dru* stand for wood in general as well as for articles fashioned out of it. A large proportion of the wood brought in from the nearby jungles was burnt as fuel. A passage in the Ṛgveda alludes to fire as reducing wood into ashes and likens it to a goldsmith who fuses metal.[15] The later Vedic texts contain several descriptions of the use of wood both in sacrificial and domestic fires.[16] Besides this, *dāru* and *dru* designate a variety of articles carved out of wood.

References to *dāru* are found scattered throughout the Vedic literature and reflect wooden objects, such as chariots, wagons, boats, posts and sticks, containers and vessels. Ṛgveda (X.102.8) describes the fastening of leather straps around *dāru* which indicates the wooden body or pole of a chariot. In X.155.3, we notice a *dāru* which is floating across the sea-shore and is strong enough to destroy (*durhaṇo*) things. In some of the texts, it has been mentioned in the sense of a pillar or stake to which a victim is tied by a rope.[17] The Śatapatha Brāhmaṇa (V.4.3.16) groups *dāru* and *vanaspati* as synonyms[18] and states that there are two types of objects coming from trees, the wheels of chariots and of wagons.[19] The Taittirīya Brāhmaṇa (II.5.5.7) makes allusions to a wagon (*śakaṭī*) and also to the cutting of wood to the size required by the carpenter, which seem to indicate the cutting of logs of wood and shaping the parts of wagons. Elsewhere, *dāru* denotes wooden vessels, which, in comparison with vessels of other materials, were considered to be specially sacred.[20]

Dru, accompanied with suffix *ṇa* occurs six times in the Ṛgveda and characterizes different objects. In a verse addressed to the Ṛbhus, *druṇaḥ* is associated with *camasa*,[21] the bowl, naturally implying that the vessel was shaped out of wood. An allusion to a *druṇā* containing *soma* occurs in the Ṛgveda (IX.1.2). Interestingly, it refers to its womb (*yonim*) as *ayohatam*[22] which, as Mahīdhara suggests, means fabricated by a carpenter with iron tools. The Ṛgveda (X.101.10) avers that adzes (*vāśī*) made of stone (*aśmanmayī*) were also employed for fabricating wooden vessels. Just as *dāru*, *druṇā* sometimes conveys the sense of a boat[23] and also of a chariot,[24] obviously because of their being carved out of wood.

Dru is also found in the form of certain compounds, such as *dru-pada*, *dru-hantara*, *dru-ghaṇa* and *dru-vaya* which emanate from *dru* and delineate their wooden character. *Drupada*[25] stands for a wooden post or pillar to which a sacrificial victim[26] or a person charged with theft or other crime was tied.[27] Sometimes, metallic posts were also erected as is evident from the descriptions of *ayasmaya drupade* in the Atharvaveda.[28] The compounds *dru-hantara* and *drughaṇa* which emanate from *dru* + *han*, to strike, smite or hew, are etymologically similar (as *ha* in the former has grammatically been transformed into *gha* in the latter) and connote a tree-smiter or an instrument employed for cutting a tree or wood. *Dru-vaya* occurs as the epithets of *dundubhi*,[29] the war-drum and *upaśvasa*,[30] the blower, and apparently means framed of wood.

A direct derivative of *dru* is the term *droṇa* which is abundantly found standing independently as well as in the form of compounds such as *droṇakalaśa*, *droṇāhāvam*, *droṇasācam* and *droṇacitam*. *Droṇa* provides the sense of timber wherein fire is manifested[31] and of objects such as posts,[32] chariots[33] and vessels,[34] evidently made of wood. When combined with *kalaśa*,[35] it refers to a wooden vessel pre-eminently employed for *soma* preservation[36] during sacrifices. *Droṇāhāvam*, reference to which is found only once in the Ṛgveda (X.101.7) denotes a huge wooden tub where cattle are brought to take water. *Droṇasācam*[37] literally means one who is using the *droṇa* or the wooden jar, whereas *droṇacitam*[38] connotes the construction of an altar in the form of a *droṇa*.

Apart from the articles enumerated under *dāru*, *dru* and *droṇa*, the Vedas are replete with numerous allusions to objects which are mentioned independently by their names and bear an obvious wooden character. These comprise: *āhāva*, *kalaśa*, *kośa*, *camasa*, *camu*, *juhū*, *sruk*, *sruv*, etc.; *āsandī*, the seat; *ulūkhala* and *musala*, meaning mortar and pestle; and *yūpa*, the wooden post to be erected during sacrifices. These primarily belong to the paraphernalia of

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articles required in sacrifices and rituals. Wood was also profusely employed for devising implements, such as *abhri* (spade), *khanitra* (shovel), *dātra* and *sṛṇi* (sickles). Pointed sticks or goads are mentioned as *aṣṭrā, tottra* and *toda* and different types of ploughs are known as *ara, vṛka, lāṅgala* and *sīra.* Wood was a primary material for erecting doors, door-posts, beams, cross-beams and wicker-work in different kinds of dwellings, references to which are found as *dama, duryya, duroṇa, gṛha, śālā, sadana, harmya, śaraṇa* etc. Wood was required for constructing modes of locomotion both on land and water. Surface transport was by vehicles of such types as *anas, śakaṭī* or *śakaṭa* and *ratha,* while water transport depended on floats or ferry boats called *plava* and larger ones known as *nau* or *nāva.* All these contraptions were evolved from hard wood[39] strong enough to bear the burden of loads[40] and to withstand the shocks of movement at high speed[41] over long distances on a rough surface. A plethora of wooden objects recorded in the Vedic literature indubitably affirms the primacy of wood and woodcraft during this period.

Carpenter and Chariot-Wright: The artisan endowed with the onus of fashioning these articles is mentioned as *takṣan.* Derived from the root *takṣ,* to fashion, *takṣan* etymologically means the fashioner who in the early IE contexts designates none but a carpenter. Equivalents of the Vedic *takṣan* are *tašan* in Avestan and *tektōn* in Greek. He is the earthly replica of Tvaṣṭṛ, the celestial artificer whose technological skills of a multifarious nature are described in a fashion which corresponds more to a wordly carpenter than to a divine celebrity. He is *per se* an expert of his craft, mentioned as he is among the specialists such as the physician (*bhiṣak*) and priest (*brāhmaṇa*)[42] and the craftsmen such as chariot-wright (*rathakāra*), potter (*kutāla*) and blacksmith (*karmāra*).[43] He used to undertake several kinds of wood-work including making chariots, wagons, vessels, sacrificial stakes etc. Cutting of the sacrificial stake (*yūpa*), fastening of the wooden ring (*caṣāla*) on its top and fashioning of wooden vessels are found enumerated amongst the major jobs that he often handles[44] with the instruments such as *vāśī* (=*vāśīla* = *vaśulā,* adze),[45] sometimes made of stone (*aśmanmayī*) and *svadhiti* (chisel).[46] The Ṛgveda (I.105.18) refers to the pain of a carpenter caused by the strain in his work.[47]

From the common class of carpenters emerged the group of chariot-wrights (*rathakāra*) mainly on the basis of specialized knowledge in fabricating them. That the emergence of the group is later is evident from the fact that there is no evidence of its existence in the Ṛgveda, the popularity of chariots notwithstanding. It appears that the responsibility of designing and framing chariots fell in the beginning to the lot of carpenters (*takṣan*) but, with the increasing demands of the socio-political life of the Aryans, a group of carpenters specializing in the craft of chariot-making, and possessed with highly valued innovative skills, crystallized in the form of *rathakāras* to become one of the most respected professional classes during the later Vedic period.[48] The Taittirīya Brāhmaṇa (III.4.1.2) specially praises a *rathakāra* for his intelligence (*medhā*) and a *takṣan* for his patience (*dhairyya*), indicating thereby that their work required a lot of intelligence and patience. Besides the allusions depicting both of them as professional classes, they figure among the people who take part in royal consecration (*rājasūya*) and who are specifically spoken as king-makers (*rājakṛtaḥ*).[49] Such a socio-religious recognition accorded to the classes of carpenters and chariot-wrights, attests to their increasing importance, emanating from their technical knowledge of the crafts which, because of necessity, played a prominent role in Vedic society.

Carpenter's Tools: Big strides in the domain of woodcraft were made possible by the introduction of a number of tools efficiently handled by Vedic carpenters in order to obtain the desired results. Though the stone-tool tradition was still lingering, metals had become quite popular, resulting in the fabrication of stronger and sharper artifacts which allowed some finer working in wood. Use of stone tools vis-à-vis those of metals may be evidenced from the Ṛgveda which refers to adzes made of stone[50] in shaping wooden vessels. Likewise, the

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advance in metal technology is marked by numerous references to the *ayas* (a generic term for metals), *dhmātṛ* (smelter of metals)[51] and *karmāra* (smith).[52]

Tools mentioned in the Vedic literature in connection with wood-working are *kuliśa, paraśu, drughaṇa, svadhiti* and *vāśī*.

Kuliśa[53] was mainly a cutting instrument, an axe. It was employed in cutting down trees into logs and also in fashioning chariots. It seems to have had the shape of a modern *kulhāḍī*, usually with a thick iron blade fitted to a wooden handle through an opening in the upper part, providing a sharp cutting edge running parallel to the handle in the lower part. *Paraśu*[54] appears to be another variety of axe, presumably having a much wider edge than a *kuliśa*. A good number of passages[55] depict it as an artifact employed for cutting trees. Sometimes, it is found with the epithet *dru-hantara* (*dru*, 'wood' + *hantara*, 'cutter')[56] which signifies the real quality of the tool as a mighty wood-cutter.[57] Interestingly, a *paraśu* of fine metal and with sharpened edge has been mentioned in the Ṛgveda (X.53.9) in connection with fashioning wooden vessels by Tvaṣṭṛ. It was also sometimes used as a battle-axe.[58] *Drughaṇa*,[59] which also occurs in the form of *dru-hantara*[60] (obviously of the same descent), bears a close resemblance with *paraśu* and connotes a tree-smiter or wood-cutter. It is, in fact, a qualitative form of nomenclature which points to the tool's competence in cutting down a tree or through wood. However, in a secondary sense, it also meant a mace[61] made of wood. *Svadhiti*,[62] is mentioned in connections with creating well-made forms (*rūpam sukṛtam*),[63] trimming the sacrificial stake, cutting down the trees and dissecting the body of a sacrificial horse. A passage in the Ṛgveda refers to its sharpening on a whetstone.[64] Sometimes, sharpening seems to have been effected by furnacing the instrument in a high temperature and subsequently, perhaps by hammering its edge, as is evidenced from descriptions about the reddish and radiant *svadhiti* in several passages.[65] In all probability, it designated an instrument of the chisel type.[66] Amongst the several implements handled by carpenters one which deserves particular mention is the *vāśī* (= *vāśīla* = *vaśulā*), meaning adze, which, like its modern equivalent, appears to be an accurate and versatile tool used for cutting, shaping, planing, smoothing, hollowing and fabricating mortises-and-tenons. It occurs in reference to preparing wooden vessels and furnishing them with ornamentation of encircling bands, presumably by trimming, smoothing and hollowing. As mentioned earlier, adzes were made of metal as well as of stone.

Techniques of Woodworking: Working in wood depended on the techniques of cutting, trimming, scraping, planing, and strapping the essential parts of wooden objects with cords and rawhide thongs and dovetailing by cutting mortises and tenons. In several instances these are evident from direct allusions but sometimes the kind of tool employed enables us to form an idea about it.

In order of priority, the technique which is basic for woodcraft and, hence, has largely been mentioned is that of cutting.[67] Logs of wood were cut with instruments such as *kuliśa, paraśu* and *drughaṇa* or *druhantara*, as per requirement and shaped into desired article.[68] Evidently, this involved a long process and demanded a great deal of labour and expertise from the carpenter. He must have marked accurately the unnecessary portions in the log or lump to scrape them out with an adze or chisel. Despite the fact that the direct evidence pertaining to various techniques used by carpenters is tantalizingly rare, these may nevertheless be conceived on the basis of descriptions of the objects prepared and tools employed. Some of these are:

1. *Vāśī* technique or adzing
2. *Garta* technique or hollowing
3. *Nahana* technique or strapping
4. Technique of joinery by cutting mortises and fixing tenons.

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Vāśī-technique or adzing apparently means one accomplished with a *vāśī* or an adze which, being a versatile implement and one easiest to handle, was efficiently used for cutting, trimming, planing, smoothing, projecting the corners as we notice in connections with sacrificial posts (*yūpa*) and other pieces of equipment. These are eloquently mentioned quite a number of times with reference to the root *takṣ*, to fashion. *Garta*-technique is one in which the objects are prepared by hollowing. This may be evinced from the shaping of sacrificial posts which had to be carved hollow[69] for fixing the wooden ring (*caṣāla*) at the top. Though direct evidence of the use of this technique is rare, it is well-nigh certain that a number of articles such as containers of different varieties, mortars (*ulūkhala*), boats (*nāva* or *nau*) and canoes (*plava*) were produced by hollowing. *Nahana* (from root *nah*, to fasten, lash)-technique depended on strapping the various parts with cords or rawhide thongs in the process of making an article of utility. Some specific products of this technique are the bow, yoke (*yuga*), seat (*āsandī*), and the body of a chariot (*kośa*). This technique was also applied in erecting dwellings (*śālā*). Obviously, the *nahana* technique is not so much dependent on the handling of tools as on the selection of ties of various sorts and the wooden parts finally to be fastened together. The culmination of the carpenter's skills during the Vedic period is witnessed in their works of joinery, often furnished by cutting mortise-and-tenon joints, i.e. dovetailing. A unique product of this technique is the chariot or wagon wheel, which was fitted to the extremity of an axle (*akṣa*) by cutting out a hole (*kha*) at its 'navel' (*nābhi*) or centre. The wheel also possessed a number of spokes (*ara*) which ran from the navel (*nābhi*) to its felly (*pradhi*). These seem to have been inserted and tightly fixed at both ends by cutting mortises, for a loosely fitted wheel or spoke would never be able to cope with the strains in a fast moving chariot (*ratha*), sometimes spoken of as 'speedier than thought'.[70] An example of the application of this technique is further furnished by the sacrificial post (*yūpa*) which had a tenon-like projection at the top to be fitted to a ring (*caṣāla*) by cutting a mortise. All these works of joinery, rendered with geometric precision with the help of a penetrating instrument, such as a *svadhiti* (chisel), stand as the highest watermark attained by the Vedic carpenter in the field of his craftsmanship.

(b) Leather Craft

An important product of *takṣ* technology is the craft of leather which was being practised from remotest times. The craft, as depicted in the Vedic literature, reflects an IE borrowing as several terms such as *carman, dṛti, tvac, ūrṇa, ajina* etc. for skin and leather are found existing in different shapes in several languages of the IE family.

Thus, the Sanskrit *carman* is similar to the Latin *corium*, meaning 'hide and leather' (Italian *cuorio*, French *cuir*, Spanish *cuero*, all mostly leather but sometimes skin, hide), Polish *skora*, Russian *škura*, Avestan *caraman*, etc.[71] Cognates of *dṛti* are found in Greek *derma, dora, dero* (hide, skin), Luthuanian *dirti* (flay, skin), and Old English *teran* (tear).[72] The Sanskrit *ūraṇa* or *ūrṇa*, which initially meant a clothing of sheepskin is similar to the Latin *vren-on-es, renones*, and the Greek *arēn, arnos, arneios, arnakides*, sheepskins.[73] The cognates of the Sanskrit *tvac* is found in the Greek *sakos*, meaning shield. Likewise, the Sankrit word *ajina* is equivalent to the Church-Slavic *jazno*, leather.[74]

A semantic study of these terms provides some interesting revelations. Some of them, such as the Sanskrit *tvac* and the Greek *sakos*, mostly denoted the outer covering of the body but in course of time also denoted leather and leather products. There are certain terms which are based on the names of animals. For instance, *ajina* and its counterpart in Church Slavic, *jazno*, have been derived from *aja*, meaning goat. Similarly, Latin *renones*, Greek *arēn, arnakides*, and Sanskrit *ūraṇa* were evolved from *urā*, sheep (a derivative of IE *wer*, to cover, Sanskrit *vṛ*, to protect, cover) and designated the skin of sheep. Another instance of this sort of derivation, confined to the literary tradition of the Indo-Aryans alone, is the Sanskrit word *go* which,

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originally denoting a cow, has also been employed for hide and leather. Mention may be made in this connection of the words which are derived from the technological processes through which skin and hide were initially procured. Falling in this category are the Sanskrit *carman* and *dṛti* and their several cognates surviving in different literary traditions. The term *carman* and its equivalents in other languages are all derivatives from the IE root(s) *ker*, to cut, shear, etc. Likewise, *dṛti* and its cognates have been evolved from root *dṛ*, to tear, split, etc. Both the terms and their cognates which happen to be most widespread and of the earliest stock among all existing words for hide, skin and leather, suggest that leathercraft could make considerable progress only when the techniques for cutting, splitting and shearing, dependent on the evolution of certain tools, were known. As a matter of fact, the terms carry with them a sense which seems to have originated during prehistoric times, when special implements were devised for skinning and flaying animals.

Practised from the remotest times, leathercraft acquired a new fillip in the hands of the Indo-Aryans. Abundance of animal resources, both of wild and domestic varieties, in the Indian subcontinent provided them with an opportunity for restructuring their leather-based necessities concerning day-to-day life and those of their religious life. The leather goods required in day-to-day life included leather thongs or straps (*varatrā*) to fasten together the parts of a chariot (*ratha*) or a yoke (*yug*) and sometimes to draw water from a well, leather bags and bottles (*dṛtis*) to store a variety of things, mostly liquids, bowstrings (*jyā*), slings, shoes and sandals. Sometimes, leather was also used as a garment. In religious life, the hides of cows, oxen and black antelope were considered especially sacred and, therefore, were employed in different ceremonials. Ox-hide was often used to prepare a seat for the sacrificer or for the bride in a marriage ceremony. It was also an essential item at the *soma*-pressing ceremony. Likewise, the hide of a black antelope was considered sacred and employed at the performance of *śrauta*—sacrifices. The popularity of hides and skins as well as leather in a number of religious and non-religious functions undoubtedly provided a spur to the development of leathercraft which was handed down to the Indo-Aryans from a hoary past.

Terms Denoting Leather and Leather Articles: Basic words denoting hide, skin and leather and their finished products in the Vedic literature are *carman, dṛti, tvac, ūrṇa, kṛtti, go* and *ajina*.

A number of descriptions in the Ṛgveda show that *carman* was procured after slaughtering animals. Conceiving the expanse of the firmament as an act of Varuṇa, a verse in the text compares him with *śamitṛ*, the currier, who slaughters the animal[75] and spreads its *carman*, evidently in the process of tanning. It is worthy to note that the act of spreading the *carman* has further been alluded to in several passages.[76] In one instance,[77] a verse compares the encompassing darkness with *carman* lying over the earth (perhaps in the form of a dwelling) and invokes the sun to destroy this black abode (*asitam vasma*) by his rays. *Carman* stands for hide, especially of the ox, employed in several auspicious domestic rituals and *soma*-pressing ceremonies. An insight into the working of leather is obtained from references to *ārdre carman* (moistened hide),[78] *carmāṇi mlātāni*[79] (dressed hides) and further to *carmamnāḥ* (from *carman* + root *mnā, abhyāse*, to practise), literally those who practise leather, more appropriately, the leather-craft.

Derived from the root *dṛ* (to tear or cut), *dṛti* echoes a primitive technology of tearing or cutting involved in the working of leather. However, in the Vedic literature *dṛti* stands more for the finished articles, mostly bags or bottles[81] containing liquids than for raw hide or skin. In certain cases,[82] the term *dṛti* provides the sense of bellows, a contrivance made up of leather for producing a current of air to blow up fire used by a melter (*dhmātā* from root *dhmā*, to blow).

The word *tvac* which sometimes stands for the outer surface of the cloud or for the crust of the earth generally means human and animal skin or hide. From a number of references scattered in the Vedic literature, it may be gathered that *tvac* of cow, ox, goat, sheep and horse

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and, sometimes, even of snake[83] was employed for different purposes. The *tvac* or hide obtained from the skin of a sheep was considered to be most advantageous as it provided a protective cover both to men and cattle.[84]

The term *ūrṇa* or *ūrṇā*, which signifies wool in the literature of the Indo-Aryans, originally meant a clothing of sheepskin. This is affirmed by the Greco-Latin equivalents of *ūrṇā*—the Greek *arēn, arnos, arneious, arnakides* (sheep-skins) and the Latin *renones*, meaning a clothing of sheepskin.[85] Though *ūrṇā* as a clothing of sheepskin is not traceable in the Vedic literature, it is quite interesting that the root *ūrṇu*, meaning to cover or clothe, is frequently mentioned. It appears that the root *ūrṇu*, initially designated a clothing of sheepskin, as the Greco-Latin tradition shows, but later on when the techniques of shearing, weaving and knitting were fully evolved, came to be employed for woollen clothing.

Kṛtti, a derivative of the root *kṛt*, to cut, occurs only once in the Ṛgveda. Commenting on the passage, *mahīva kṛttiḥ śaraṇā ta indra* (VIII.90.6), mentioned in the text, Yāska observes that *kṛtti* signifies fame or food.[86] But this interpretation may hardly be accepted as the passage eloquently describes *śaraṇa*, meaning an abode belonging to Indra, and assumes it to be as vast as *kṛtti*. Conversely, *kṛtti* is a vast abode, presumably made of stretched-out hides and comparable to *asitam vasma*, the black abode, occurring in Ṛgveda (IV.13.4) in reference to *carman*. In the later Vedic literature, *kṛtti* is prominently depicted as a garment of leather. In a cryptic allusion in the Atharvaveda, the Kukundhas and Kukūrabhas, of doubtful identity are depicted as bearing the hides (*kṛtti*) and pelts (*dūrśa*).[87] Quite significant is the term *kṛttivāsas*, persons wearing leather garments. This sort of practice is specifically associated with Rudra,[88] the malevolent deity of the Vedic pantheon. This may be taken to be the atvastic element of the primitive times when hides and skins were used as protective covers by human beings.

One of the hide denominators is the term *go* which initially stood for a bovine animal but subsequently also meant the hide of a cow or a bull. Some specific uses of *go* accounted in the Vedic literature comprise strapping of the parts of chariots,[89] of course, by cutting it into thongs, covering pre-made forms[90] and also fashioning arrows with the sinews of cowhide.[91]

Derived from *aja*, meaning goat, *ajina* literally connotes something pertaining to a goat, especially its hide. Notwithstanding its descent, *ajina* has often been used as a general word for hide. For instance, it denoted the hide of a gazelle in the compound *hariṇasyājina*,[92] and of a bull and black antelope respectively in the compounds *vṛṣājina*,[93] and *kṛṣṇājina*.[94] Amongst these, leather of a black antelope was considered specially sacred and, therefore, was prescribed as a garment for *brahmacārin*. It was employed at the performance of different ceremonials, such as pressing of *soma* and carrying of soil to be used for shaping ritualistic pots, *ukhā* and *mahāvīra*. Meanwhile, we also find references to *ajinavāśin*,[95] one clothed in leather, and to *ajinasaṁdha*,[96] perhaps the furrier's trade.[97]

Beside these, there are several words which stand independently for a number of leather goods. Some of these are *upānaha* (*up*+ *ā*+ *naha* from root *nah*, to fasten, bind) meaning shoes and sandals, *usriyā*, the hide of cow employed in fashioning the war-drum (*dundubhi*), *kārotara*, a vessel of leather for keeping the spirituous liquor, *kośa*, meaning a leather bag or bottle, *jyā*, the bow-string and *varatrā*, the thongs or straps of leather used as fasteners in several works.

Processing and Tanning: Despite the fact that the number of leather articles enumerated in the literature is quite large, it makes only some casual references regarding their manufacturing techniques. As a result, much of the technique of leather-working can only be inferred from casual references.

Two types of leather articles may be differentiated in the Vedic literature—first, those involving only partial processing and tanning, and, second articles necessitating elaborate working. Under the first, mention may be made of pelts used for seats or for carrying the clay required for shaping ritualistic pots. Perhaps, because of temporary uses, these were not subjected to an elaborate processing. Usually, only the flesh or fat below the corium was

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properly removed and the epidermis, especially in the case of black antelope, was retained. And after the pelts had dried sufficiently, these were taken for use.

Nevertheless, there were some leather articles, such as containers (*kośa*), bags and bottles (*dṛti*), shoes and sandals (*upānaha*) and several kinds of garments (*kṛtti*) which required elaborate processing. Though the details of the processing are not usually found in the Vedic literature, we come across a few allusions which shed some light on it. The process began with the skinning of an animal. The Ṛgveda contains some candid expressions for skinning in the form of *tvacam arandhayat* (I.130.8), *apatvacam* (IX.41.1), *tvacam bhindhi* (X.87.5), etc. In the Atharvaveda (IX.5.4) reference has been made to *viśastṛ* who is called upon to take off the skin with the help of an *asi* (knife) made of dark (*śyām*) metal. After the hide was removed from the body of the animal, it was subjected to the process of tanning which is evident from the use of roots *mlā* and *mnā* and their derivatives *mala, mlāta*, etc. Derived from the IE root *mel*, to colour or dye, *mlā* and *mnā* originally meant preparing garments of leather. The Ṛgveda refers to *carmāṇi mlātāni*, i.e. dressed hides, hundred (*śatam*) in number. In another passage, the text makes an allusion to *carmamnāḥ* (from *carman* + root *mnā*) literally those who dress or tan the leather. It is noteworthy that there are specific descriptions in the texts involving a wet hide. In the Ṛgveda (I.85.5), the earth soaked with the downpours of cloud, has been likened to the *carman* moistened by waters. A reference to moistened hide (*ārdre carman*) also occurs in the Taittirīya Saṁhitā (VII.5.9.3). As a matter of fact, the hide was put into water for soaking so that the epidermis, the hair-bearing upper layer, could be properly removed. The presumption gets strengthened from the use of the Sanskrit root *suda, kṣaraṇe*, to sprinkle, along with *śamitṛ*, meaning currier, occurring in several passages,[98] which symbolize that tanning was effected by moistening the hide, probably in a pit or vat, as practised by the curriers even today. The moistened hide was then put out for drying as may be inferred from different allusions to stretched-out hide.[99] The Śatapatha Brāhmaṇa (II.1.1.10) mentions that the hide was strewn and held steadily by the *śaṅkus* or wooden beams.

Techniques: After the hide was properly tanned and transformed into leather, it was used for manufacturing a variety of articles which, as noted earlier, were quite large in number. Obviously, these were procured by applying different techniques, some of which were as mentioned below.

(a) *Cutting*: This happened to be the predominant technique as may be inferred from the etymologies of the terms *carman, dṛti* and *kṛtti*, all meaning leather. As mentioned earlier, *carman* is a derivative of the IE root(s) *ker*, to cut, shear. Likewise, *dṛti* and *kṛtti* are respectively traced from the roots *dṛ*, to tear or split, and *kṛt*, to cut. In fact, the very nature of the material used in this craft is such that the fashioning of an object can never be imagined without cutting, which was primarily performed with the help of instruments known as *asi* and *svadhiti*.

(b) *Thongs and Strapping*: From leather, long strips, thongs and straps can be cut, something that was not possible from other available materials. The Vedic literature avers that the thongs and straps usually known as *varatrā* were employed for making bow-strings (*jyā*),[100] fastening plough[101] and yoke[102] with the pullers (*vāhāḥ*), strapping the parts of wagons and chariots together and, sometimes, as a long rope to draw water from a well.[103] Long and continuous strands such as needed for rope-making, became possible only when the hide was cut spirally with a sharp-edged tool of the chisel type. However, in the case of small thongs, it was cut in the corners.

(c) *Sewing*: This may be inferred from the types of articles made, such as dresses (*kṛtti*), and bags and bottles (*dṛti*) which can only be prepared by joining sheets of leather through needle-work. References to *sūcī* (needle) and the root, *sīv*, to sew, also affirm the prevalence of the technique.

(d) *Moulding*: This technique was widely practised for making bags, bottles and buckets and also bellows to blow up fires. This necessitated the moulding of well-tanned leather to the

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desired shape after thorough softening with water. In the process, it was perhaps coaxed, pressed or beaten in moulds or over cores of hardened clay or wood. Afterwards, the corners were properly joined by stitching.

(e) *Draping:* We definitely know that garments of leather, such as *kṛtti* and *mala*, were sometimes worn by the people during the Vedic period. As raw hide hardens too much after drying and becomes unsuitable for wearing, garments could be fashioned after the hide was softened well through the process of tanning. This provided leather suitable for clothing and soft enough for hanging.

(f) *Covering:* Evidence for the application of this technique is found in a reference in the Ṛgveda (VIII.90.6) to the erection of an abode (*śaraṇa*), constructed of stretched-out leather (*mahīva kṛttiḥ*). Likewise, a passage in the text alludes to *asitam vasma*, the black abode made of *carman*[104] and another to a chariot, covered with cowhide.[105] In all these instances, hide or a big sheet prepared by joining several hides was stretched over a structure made of wood, so that it may provide a protective cover and be used as an abode. In the case of chariots, the uppermost body, mentioned as *kośa* or receptacle was covered with hide which was possibly fastened with straps or thongs so that it may stay firmly in its place against the speed of the vehicle. Examples of covering some pre-made forms such as *dundubhi*, the war drum,[106] and *āsandī*, the seat,[107] are also found.

The Currier And His Implements: The artisan who had mastered all these techniques to produce a number of leather goods is described as a *śamitṛ* (from the root *śam*, to destroy) meaning currier in Vedic literature. To his lot fell a number of responsibilities. During an animal sacrifice, he used to prepare the animal, make marks on its body, pierce its limbs and cause the immolation.[108] An important ritualistic function of the *śamitṛ* was to cook the oblation from the flesh of the sacrificial animal, which was offered to the gods and the priests.[109] However, the currier's real importance was due to his professional expertise as a craftsman. Besides the procurement of hide, his work included its tanning and the production of quite a large number of leather articles.

In a craft such as leather, the scope for the use of manufacturing tools had always been limited till the advent of machines converted it into a big industry. Comparably, it was not the tools but the techniques which mattered most during the Vedic period. In several cases, such as covering, moulding and draping, preparation of a flexible leather was utmost required and the tools had little to do. Still, there were certain tools such as *asi*, *svadhiti*, and *sūcī* which were needed for skinning, cutting and sewing.

Asi, a versatile tool, probably a type of a big knife, was employed for killing, cutting and piercing.[110] It is sometimes eloquently described as made of good metal (*svāyasā asayaḥ*).[111] *Svadhiti* appears to be a sharp-edged tool of the shape of a chisel,[112] employed for several purposes, including dissecting and piercing.[113] *Sūcī*,[114] derived from the Sanskrit root *sīv*, to sew, means a needle used for sewing, presumably with the long strands or thongs of leather (*varatrā*) which passed through a series of holes pierced by this small implement. The tools employed by a *śamitṛ* or currier, though limited in number, were sufficient for procuring the kind of leather articles the Vedic Aryans required.

(c) Textiles

Etymologically, the word 'textile' is a descendant of the Latin root *texere*, weave, which is found incorporated in a number of modern European languages.[115] Though the Latin alone has specialized the root in this sense, it is closely connected with the IE root *tek*, Sanskrit *takṣ*, Avestan *taš*, and Greco-Roman *technos*, which express all sorts of technological actions. And, thus, *texere* bears the primary sense of 'construct artfully'.[116] A diminishing echo of this connection is also preserved in the Ṛgveda (V.29.15) which likens the creation of new praises to the making of clothing and a chariot. But the description is exceptional as the popular

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names for garments and clothing such as *vās, vāsas, vasana, vastra, suvasana,* etc., in the Vedic literature are possessed more with the utilitarian sense than that of technology. These emanate from the root *vas acchādane,* to cover, which indicates that the notion of covering was of primary importance in inspiring the emergence of clothing in the Vedic tradition.

The Vedas refer to *ūrṇā, mala, kṛtti, ajina, kṣauma, tārpya, barāsī* and the grass-like *kuśa* as the materials used for making garments and clothing. While the Ṛgveda is familiar only with the first two, all of them are found enumerated in the later Vedic literature. It has been noted earlier, in connection with leathercraft, that *ūrṇu – ūrṇā* stands for sheepskin and later for wool. *Mala,* a derivative of the root *mlā,* to tan, designates a garment of leather and later a coloured garment. *Kṛtti* (from the root *kṛt,* to cut) and *ajina* denote leather, the latter mostly occurring as *kṛṣṇājina,* that of the black antelope, which was considered specially sacred. It is not exactly known which materials *kṣauma, tārpya* or *barāsī* represent. It is highly doubtful that *kṣauma* or *tārpya* stood for silk, as has sometimes been speculatively asserted. *Kṣauma* was perhaps obtained from the plant *kṣumā. Tārpya*[117] was essentially a 'ritual royal dress' made of grasses such as *darbha* and *kuśa.*[118] *Barāsī* was in all probability a garment made of the bark of the tree *barasa.*[119] A skirt-like garment (*caṇḍātaka*) prepared from the *kuśa* grass was also in vogue.[120] It was sometimes worn during the performance of sacrifices. The most striking thing amongst all these terms is the absence of a word for cotton, otherwise known to be prevalent in the Indus Valley civilization. Nevertheless, the possibility of its presence in the words *tantu* and *sūtra* cannot be entirely ruled out.

The garments worn by the Vedic people were usually of two types—*vāsas,* the lower garment and *adhivāsas,* the upper garment, which seem to have been long pieces of cloth to be draped respectively around the waist and over the shoulders. Later on, *nīvi,* an undergarment, was also added to male and female attire. Some other garments to which references have specifically been made are *atka, drāpi* and *varma,* dresses of the cloak or mantle sort, and *uṣṇīṣa,* the head-dress or turban which was worn both by men and women, particularly kings during the coronation ceremony. In addition, there were dresses to be worn on certain occasions. We come across a garment for brides (*vadhvo vāsa* or *vādhūya*) which was worn at the marriage ceremony and afterwards given to a Brahmin.[121] The Śatapatha Brāhmaṇa (V.2.1.8) makes a reference to a skirt like garment of *kuśa* worn by the wife of the sacrificer. The text describes the sacrificial dress as consisting of a garment of undyed wool, an undergarment of *tārpya,* an outer garment like *adhivāsa,* and a head-dress or turban (*uṣṇīṣa*). Dresses marked with ornamentations or fine embroidery were worn by female dancers.[122]

Dresses were sometimes a mark of distinction for certain people. Mendicants usually draped a brown (*piśaṅga*) attire.[123] The *brahmacārins* used to wear a garment prepared from the hide of a black antelope (*kṛṣṇājina*). The Atharvaveda (I.17.1) depicts brotherless (*abhrātara*) sisters as wearing a kind of red dress (*lohitavāsa*).[124] People generally liked to be well dressed as is evident from the description, *bhadram vāsānaḥ, śriyo vasānaḥ, cāru vasāno,* and terms such as *suvasana, suvāsāḥ* etc. occurring quite frequently in the texts. Underlining the significance of dress for the person of a man, the Śatapatha Brāhmaṇa (XIII.4.1.15) eloquently expresses the view that a garment can enhance the physical beauty of a man.[125]

The process through which dresses were generally acquired comprised obtaining the fibre or thread, spinning, weaving, stitching, embroidering and dyeing.

The Fibre and Thread

The first prerequisite for making a textile material is thread, which was in prehistoric times extracted from a number of vegetable or animal tissues. In the lack of a specific reference to the former in the Ṛgveda, animal tissues in the form of hairs of sheep and goat, known as *ūrṇā* constituted the foremost source for drawing the thread which has been described as *tantu* (from the root *tan,* to spread) and later as *sūtra* (from the root *su,* to extract)

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or *ūrṇā-sūtra* (woollen thread). As the bulk of the wool came from sheep, it has often been designated as *ūrṇāvatī*.[126] Though the texts are not very specific about making the thread, it may, however, be imagined on the basis of the Ṛgveda (X.130.2) that it was obtained by rolling the fibre. It says, 'The first man spreads out (*tanuta*); the first man rolls (*kṛṇatti*) it up, he spreads (*vi-tatne*) it above in this heaven; these pegs (*mayūkhā*) have settled down on the spot; they have made the prayers serve as shuttles (*tasarāṇi*) for woof (*otu*).' The verse employs the word *kṛṇatti* from the root *kṛtī veṣṭane*, to roll or spin, and encompasses several essentials of spinning and weaving.[127]

Weaving

This was undoubtedly a popular art since the beginning of the Vedic period and one of the principal means to acquire clothing. This is obvious from the prolific descriptions of root *veñ, tantusaṁtāne*, to weave, and its several verbal and nominal derivatives sprinkled over the Ṛgveda, and which later form the paraphernalia of the craft of weaving. It was sustained by interlacing the threads, the warp and woof, respectively rendered as *tantu* and *otu* in the Ṛgveda, especially when the former is referred to in contradistinction to the latter.[128] Warp has also been described as *pracīnatāna*[129] in the later Vedic literature. It was stretched on pegs (*mayūkhā*)[130] and the woof was interwoven with the help of shuttles (*tasara*) and loom (*vemana*). The Ṛgveda (X.71.9) alludes to *sirīstantraṁ*, the weaver's web. Making a pointed reference to the craft, the Atharvaveda (X.7.42) describes a pair of maidens engaged in weaving stretching the web on six pegs (*ṣaṇmayūkham*), one of them drawing forth the threads and the other holding them (so that these are not broken).[131] It may be adduced from the above that the web for weaving was stretched by as many pegs as were required and, sometimes, the weaver was assisted by another.

Both men and women were involved in the weaving activity. The Ṛgveda (X.26.6) refers to *vāsovāya*, the weaver of garments, as an epithet of Pūṣan. Existence of female weavers is attested to by a number of passages. The Ṛgveda (II.3.6) employs the term *vayyā*, meaning the female weavers, for Uṣas and Naktā, which are assumed to be weaving day and night, the phenomena they respectively represent. In II.38.4, night is depicted as wrapping up the light like the stretched-out thread by a female weaver. Elsewhere (V.47.6), a mother is described as weaving a garment for her son.[132] These references indicate that weaving was primarily done by the females, a corollary supported by the Śatapatha Brāhmaṇa which states, 'The working in wool and thread is the work of women.'[133]

Stitching

Another means for producing clothes was stitching them which was presumably attempted for garments such as cloaks and mantles worn by the people. Prevalence of the technique is affirmed by the roots *sīv* and *syū*, meaning 'to sew' and the instruments with the names of *sūcī* and *veśī*, denoting needles in the Ṛgveda and later. A fine product of stitching was the *varma* or mantle, made from several pieces of cloth[134] and supposed to protect the wearer on all sides.[135] The stitches effected by the *sūcī* or needle were so executed that these were expected to endure for a long time.[136]

Embroidering and Dyeing

People had a great fascination for draping themselves with beautiful clothes. For this, they attempted adorning their garments with embroidery and designs which are expressed by the terms *peśa*,[137] *peśas, supeśas* etc, the derivatives of the root *piśa*, to adorn. The Ṛgveda (X.1.6) makes reference *vastrāṇyadha peśanāni vasāno*, 'putting on embroidered garments'. The Aitareya Brāhmaṇa (III.10) says, 'when a cloth is woven it is embroidered (at the border), before the actual texture is woven it is embroidered in the middle, and again it is embroidered

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at the end'. This implies a splendid work of embroidery, mostly accomplished by *peśaskāri*,[138] the female embroider.

Peśa was sometimes created by painting (*añjan*) as is evident from the Ṛgveda (I.92.5).

The texts also allude to the root *rañj*, to dye, and *rajayitrī*,[139] the female dyer, which evinces the prevalence of the craft of dyeing. This is also denoted by the specific references to *piśaṅga* and *lohitavāsa*, respectively the tawny and the red-coloured garments, and also to several terms standing for colours and dyestuffs. However, we do not obtain any information on the technical aspects of embroidering and dyeing.

(d) Minor Crafts

Apart from aforesaid crafts which were of considerable importance and widely practised by the Indo-Aryans, some other crafts depending on the *takṣ* technique were also prevalent. These include lithic (*aśman*) work, bamboo (*vaṁśa* or *veṇu*) work, reed (*vetasa*) work, the making of ropes (*rajju* or *raśanā*), and the carving of amulets (*maṇi*) etc. Several Vedic descriptions relating to these and, in the case of basic materials such as stone, bamboo and reed, to the articles produced, bespeak their usage. These are further known from the references to certain craftsmen such as *bidalakāra*,[140] basket-maker, or *bidalakārī*,[141] female basket-maker, *rajjusarja*,[142] rope-maker, and *maṇikāra*,[143] amulet maker. However, the technical details of these craftsmanships are never described.

Likewise, we do not find any allusion to an artisan of stone (*aśman*) or to his working. But the literary data amply confirm the continuance of the use of stone, evidently for several purposes. The texts often describe *adri* and *grāvāṇa*, the stones employed in the rituals of *soma*-pressing.[144] Stone was also used for erecting strong abodes.[145] Sometimes, an entire township (*pura*) is spoken of as having been constructed of stone.[146] The Ṛgveda (X.101.7) makes reference to a *aśmacakra*, which indicates the existence of a wheel-like device of stone used for lifting water from a well (*avata*). Most tantalisingly, the stone-tool tradition was still lingering on as may be gathered from several passages,[147] particularly from one which sheds light on *aśmanmayīvāśī*,[148] the stone axe. The data culled from the Ṛgveda extensively express the practice of the craftsmanship of the lithic, lack of its technological details notwithstanding.

2. THE GHARMA TECHNOLOGY

Ceramic Craft

The craft of ceramics[149] is based on mixing and moulding the clay as well as its baking. To the archaeologists, it came into existence as a fortuitous discovery of the casual firing of a clay-daubed basket or a clay-lined hearth and its subsequent hardening. With similar encounters extending over centuries, man got acquainted with the impact of a fire's heat on the shrinking, splitting and hardening of clay and he started trying to obtain the same kinds of results by deliberately shaping and firing, which inevitably led to the emergence of the craft of ceramics.

Material remains pointing to the origins of ceramics being scanty and often vague, archaeology fails to give a definite and precise answer to the question of its origin. This can, however, be explained in a much better way and authentically with the help of linguistics.

Though archaeological evidence on the emergence of ceramic technology in Early Vedic times is scanty, the terminology used for/or the names given to various pottery items, which are all (as demonstrated by the author) derivations from rootwords relating to rubbing, plastering, fire, heat, furnace and ovens. This clearly shows that the technique for providing pottery items was developed over the centuries building on the observation that basketry and other objects, including wooden and stone containers and vessels plastered over to fill the

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openings when dried hard in the sun, and particularly when subjected to heat over fire, exhibited a permanent hardening of the clay and clay plasters on mouths, ovens and furnaces also hardened similarly. Hence, the names of various types of pottery being drawn from roots of words connected with smearing, plastering, heat and heating, furnaces, ovens and mouths. Appropriate evidence concerning the first is found in the primitive Sanskrit verb *dih*, to rub over, bedaub, which expresses the action of a potter. That the practice was shared by other Indo-Europeans is evident from the existence of the corresponding roots in some other languages: Latin *fingere*, to form, mould, *figulus*, potter; Gothic *deigan*, to make of clay; Avestan *dišta* = diz = heap up, etc.[150] In the Vedic literature, the root has been employed in connection with the besmearing of arrows[151] as well as the bedaubing pre-made forms, such as *āsandī*, a seat, with clay (*mṛdā digdhā*).[152] Though in a fragmentary state, the root nevertheless represents a primitive tradition of making pots by bedaubing pre-made forms which, in course of time, fell out of use with the growth of independent knowledge of the craft of ceramics.

The next motivation which appears to be most exact in creating pots in clay came from the baking pits, ovens and furnaces. This may be affirmed by certain pot-denoting terms, such as *ukhā*, *gharma* and *caru* which occur with certain variations in a number of IE languages from the remotest times. *Ukhā*, the marvel of all the Vedic ceramics, is a popular IE term, having its cognates in the Greek *ipnos*, Gothic *auhns*, Old Norse *ofn*, Danish *ovn*, Swedish *ugn*, Old English *ofen*, New English *oven*, Old High German *ovan*—all meaning 'oven', the Sanskrit *ukhā*, Latin *aulla*, *ōlla* (= Old Italian *oglia*, Old French *oule*, Spanish *olla*, Rumanian *Oală*), etc.[153] A study of these terms indicates that the pot-name, *ukhā*, the Sanskrit cognate of 'oven', which primarily meant a fireplace, subsequently became a boiler, a pot, a receptacle for keeping fire. This can hardly be taken to be a chance resemblance. It provides a clue to the early concept of a pot being evolved from an oven or a baking pit.

The linguistic connections of *gharma* and *caru*, which like *ukhā* happen to be the earliest pottery-types of the Indo-Aryans also lead to a similar conclusion. Derived from the Sankrit root *ghṛ*, to heat, warm, *gharma* has several equivalents in Balto-Slavic, Greco-Latin and Indic languages. Some of these are: Church Slavic *grūnīcī*; Serbo-Croatian *grnac*; Bohemian *hrnek* = *hrnec*; Polish *garnek*; Russian *goršok*; Latin *furnus*, meaning oven; Sanskrit *ghṛṇa* = *gharma*, meaning heat; Greek *thermos*, hot, etc.[154] Taken together, these originally indicated some kind of heat, burning or oven. The meaning further gets confirmed from the Vedic literature where *gharma* denotes a sacrificial vessel as well as boiling liquids, heat and furnace. The Vedic *caru*, which is equivalent to the old Norse *hverr*, and Irish *core*, meaning kettle, is likewise closely associated with fire. A number of passages in the Ṛgveda allude to it as a pot for cooking flesh,[155] rice,[156] or sacrificial food.[157]

Emergence of these pottery types in direct imitation of ovens or baking-pits and their close association with fire unmistakably show that the basic urge provoking the fashioning of ceramics was the necessity of cooking. It must have been quite difficult indeed in the beginning to accomplish the purpose of cooking in vessels fashioned out of wood, stone, leather or basketry. Cooking necessitated a sturdy vessel which could be easily employed against fire without fear of its disintegration, burning the contents or loss of heat. After a search covering countless centuries, the answer came in the form of ceramics.

There were, however, some other motivations, though not so cogent, behind the origin of ceramics. A number of storage and drinking, vessels, such as *kalaśa*, *āhāva*, *kośa*, *camasa pātra*, etc., fashioned of wood and leather and *kumbha* and *budhna* existing in the forms of natural reservoirs were imitated and refashioned in ceramic form, which resulted in the growth and proliferation of ceramic craft.

Prominent Ceramic Types of the Indo-Aryans: The ceramic craft of the Indo-Aryans, as depicted in Vedic literature, consists primarily of three types of vessels: cooking vessels, storage vessels and drinking vessels.

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(a) *Cooking Vessels:* The principal types under this category are *ukhā, gharma, caru* and *sthālī. Ukhā*, a hand made ritualistic pot, was rectangular or circular (*caturasrāṁ parimaṇḍalam vā*) in shape. It had three tiers (*tryuddhim*)—the bottom (*nidhi*), the lower part (*pūrvamuddhi*) and the upper part (*uttaramuddhi*), built successively. The pot, a spacious one, was embellished with a horizontal belt (*rāsnā*), four vertical bands (*catasra ūrddhvā*), knobs (*stana*) varying from two to eight and a channel (*bila*) like feature at the mouth. Basically, the pot was employed for cooking; but, later on, it became a holy receptacle for keeping the sacrificial fire. *Gharma*, also known as *mahāvīra*, meant the fireplace, the heat, the boiling liquids and, later, a pot for cooking, especially an oblation (*haviṣa*), consisting of a mixture of *soma*, butter and milk to be used in the ritual called *Pravargya*. It was a handmade earthen pot, round in shape like the human head, one span in height (*prādeśamātram*), with a neck-like contraction in the middle (*madhye saṁgṛahītam*) and a nose (*nāsikā*)-like protraction at the mouth. The pot also possessed a belt (*mekhalā*) which ran from bottom to the neck. A *caru* was mainly employed for cooking flesh as well as rice and sacrificial oblations. It was a commodious pot like a *hāṇḍī* rather than a kettle.[158] The *sthālī* was a ritualistic vessel of the type of dish-on-stand known to the archaeologists.

(b) *Storage Vessels:* Under this category, the Vedic literature refers primarily to *kumbha* and *kumbhī, kalaśa* and *budhna*. Vessels of the *kumbha* type and its female form *kumbhī* denoted a big, round-bellied and strong-rimmed jar which accommodated a sufficient amount of liquids. In comparison to this, a *kumbhī* was smaller in size though it had a similar look. Sometimes, these had a number of perforations (*vitṛṇṇa*).[159] *Kalaśa*, a ceramic replica of *droṇakalaśa*, was used as a container for storing *soma*. It perhaps had a wide mouth which allowed the passing of *soma* inside it while being strained in a thousand (*sahasra*) or a hundred (*śata*) streams.[160] A *kalaśa*, having four orifices or channels[161] was also fashioned. *Budhna* appears to be one of the primitive pot-denominators, indicating the size of a big one, primarily employed for storing water. It was, in fact, on the basis of its capacity to hold a large volume of water that the original meaning of *budhna* underwent a change and came to be applied to the atmosphere or to the firmament whence the waters in the form of rains descend.[162]

(c) *Drinking Vessels*: Most important under this category is the *camasa* which was mostly employed for drinking *soma*. Originally made of wood, the pot got transformed into ceramic as an allusion[163] to *tiryagbilaḥ*, the slanting channel, and *ūrdhvabudhnaḥ*, the upraised base indicate. As a matter of fact, these respectively denote the channelled and footed bowls marked in the ceramic assemblages of the Painted Grey Ware culture of Northern India.

Ceramic Technology: Ceramic vessels mentioned in the Vedic literature can be divided into two groups: (a) the hand-made and (b) the wheel-turned. The first comprises *ukhā* and *gharma* or *mahāvīra*, the two prominent ritualistic pots; and the second, *khumbha, kalaśa, caru, sthālī, camasa*, etc., the fashioning of which is nowhere alluded to, but for various reasons, are believed to be wheel-turned. What we expressly find in the Vedic literature are the techniques of making handmade pots alone. As the preparation of *ukhā* and *mahāvīra* was a part of the rituals in which both the sacred vessels were employed, their fashioning has specially been taken up for detailed description. The rest of the pots, though of no less religious significance, were used ready-made. Very likely, these were produced by the potter on a wheel.[164]

Preparation and Levigation of Clay: The basic component required for fashioning a pot is clay which must be properly selected because the quality of clay determines the fabric of the resultant pot. It has been specifically mentioned that the clay should be taken from a pit located near an ant-hill (*valmīkavapā*) supposedly built on a soft soil. The clay thus procured and prepared by the potter (*kumbhakāra-saṁskṛtā*) is said to be soft enough (*aticikvaṇā*) and suitable for modelling pots (*bhāṇḍādinirmāṇayogyā*).[165] It is then kneaded with a sufficient amount of water to generate plasticity. In order to make the resultant pots tough and sturdy, the clay is further lavigated with a number of ingredients, described variously in the contexts

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of the preparation of ritualistic pots, *mahāvīra* and *ukhā*. The Taittirīya Āraṇyaka makes allusion to the kneading of (*i*) fragments of pottery used in the household (*gramyānām pātrānām kapālāḥ*), (*ii*) those collected from deserted sites (*armakapālāḥ*), (*iii*) tiny pieces of stones (*śarkarā*), (*iv*) hairs of black antelope (*kṛṣṇājinasyaloma*), and (*v*) hairs of goat (*ajaloma*), in connection with the fashioning of *mahāvīra* pots. Interestingly and quite contrarily, these have been mentioned in the Taittirīya Saṁhitā in reference to the preparation of the pot *ukhā*.[166] About the use of hard materials, such as *śarkarā*, tiny pieces of stone or pebbles, etc., the Baudhāyana Śrauta-Sūtra which, like the Taittirīya Saṁhitā, enumerates these materials except one, fragments of pottery used in the household, in fashioning the *ukhā*, and avers that these are finely crushed[167] and mixed in clay.

Ostensibly, the testimony of the texts mentioned above makes us to believe that similar ingredients were kneaded in clay to produce the *mahāvīra* and *ukhā* pots. However, the Śatapatha Brāhmaṇa and the Kātyāyana Śrauta-Sūtra provide two distinct accounts about the ingredients to be used in fashioning these pots. Referring to the lump of clay required for fashioning *mahāvīra* pots, the Śatapatha Brāhmaṇa enjoins that it must be prepared by mixing the soft soil of an anthill (*valmīkavapā*), soil dug out by a wild boar (*varāhavihatam*), and the *ādāra* plants, also called *pūtīka*[168] (*Basella cordifolia*, commonly known as *poi*). Other materials such as *gavedhukā* grass and the goat's milk (*ajāpayas*) are to be placed aside to be used in later processes.

About the fashioning of *ukhā*, both the texts refer to kneading of clay with the foam of water boiled with the resin (*kaṣāya*) of the *parṇa* or *palāśa* (*Butea frondosa*) tree and, then, to the mixing of (*i*) the hairs of a goat (*ajaloma*), (*ii*) tiny pieces of stones or pebbles (*śarkarā*), (*iii*) stone (*aśma*), and (*iv*) iron-rust (*ayorasa*).[169] The Kātyāyana Śrauta Sūtra instructs that the hard stones and pebbles be brayed into powder for mixing in the clay.[170] Describing *ayorasa*, the text avers that rust separated from heated iron and known as *kīṭa* is to be mixed in. The purpose of mixing these degraissants is obviously to equip the vessel with the desired firmness (*sthemne*).[171]

The descriptions occurring in the texts, though at variance and limited to ritualistic pots alone, undoubtedly furnish solid evidence to the rich and variegated knowledge of potters about the different materials to be mixed while lavigating clay.

Modelling: In the absence of a clear reference to the wheel-turned pot, only information concerning the modelling of handmade pots is gathered from Vedic literature. It seems to have been accomplished in two ways. In the first, the lump of clay was first modelled into the desired shape almost as a solid block. It was then gradually scooped out with the help of a reed or a stick. In the process, nearly two-thirds of the solid shape was emptied.[172] It must have been made thin and smoothened by moving the fingers and hands spirally. Such a method of making the pots is apparently noticed in connection with the modelling of *mahāvīra*.

In the second method, the vessel was shaped in parts and, as a matter of fact, by employing several lumps of clay. An allusion to this method occurs in the context of the modelling of an *ukhā*, which was to be shaped in three tiers (*tryuddhim*).[173] Firstly the base, known as *nidhi*, was shaped. A lump of clay, sufficient to form this part, was taken and beaten to spread it out.[174] Then the sides were raised.[175] Next, the lower part, which was the first elevation (*pūrvamuddhi*) on the base, was fashioned. It seems to have been made by moulding the lump into a roll and then by placing it as a coil over the sides of the base. It had to be raised up to the prescribed length. This was properly pressed into the base and smeared by applying wet clay and water.[176] In the third step, the upper part or, literally, the later elevation (*uttaramuddhi*) was constructed with another ball of clay and with the same method as was adopted in shaping the lower part. Then, the whole of the constructed vessel was smeared both inside and outside.[177]

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Making of Features: Vedic ceramics are often found to be characterized by a number of distinctive features. Some of these are the lips or channels, knobs, lids, perforations, handles and appliqué designs of belts and bands.

The appropriate word expressing a lip or channel is *bila*[178] or, sometimes, *mukha*,[179] the former occurring in references to *caru*, having five channels (*carum pañcabilam*),[180] the *kalaśa* with four channels (*kalaśam caturbilam*)[181] and the *camasa* or bowl with slanting mouth (*tiryagbilaś camasa*)[182] and the latter, in the contexts of *ṛtu* cups mentioned as 'having channels or spouts on both sides'[183] and the *mahāvīra* pot which had a nose-like protraction at the mouth.[184] A knob is denoted by the word *stana*, literally meaning nipple, which occurs as a distinctive feature of the pot *ukhā*. The Śatapatha Brāhmaṇa (VI.5.2.16) prescribes the raising of *stanas*, four in number, at the top of the four vertical bands which join the horizontal belt in the upper part of the vessel. Sometimes, the number of these *stanas* or knobs varies from two to eight[185] and, in case of a magical *ukhā*, even to nine.[186] The term which designates a lid is *apidhāna*. It has been mentioned in connections with *caru*[187] and *kumbhī*.[188] A unique type among Vedic ceramics is the perforated vessel. The actual word for perforated is *tṛṇṇa* and not *bila* as some scholars have mistakenly suggested.[189] The Śatapatha Brāhmaṇa makes allusions to a number of pots such as *kumbha* (V.5.4.27), *kumbhī* (XII.8.1.8), *sthālī* (XII.9.1.3), etc. as perforated with a hundred holes or sometimes with nine holes (V.5.4.27). Instances of perforated bricks[190] and perforated seats[191] are also found. The term expressing a handle is *ārambhaṇa* which marks the *aṁśu*[192] cups and sometimes a *camasa*.[193] Likewise, appliqué designs of belts (*rāsnā* or *mekhalā*) and bands (*ūrdhvāḥ*) were also made. These are specially noticed in references to the making of *mahāvīra* and *ukhā*. A belt (*mekhalā*), running from the bottom of the vessel *mahāvīra*, and ending at a distance of three thumbs breadth from the top, occurs as one of its distinctive features. The prominent ritualistic pot, *ukhā*, is said to be possessed with a horizontal belt (*rāsnā*),[194] shaped around on the upper part, down to which are formed the four vertical bands (*ūrdhvāḥ*),[195] making the vessel a four-cornered one. Sometimes, it is modelled as eight-cornered also.[196]

Drying, Burnishing and Fumigation: After modelling the vessel entirely, it is put in a windy place for drying.[197] When it has dried sufficiently to become leather-hard, burnishing is attempted. This is done by means of *gavedhukā* (*coix sarbata*) grass,[198] apparently by rubbing it around the vessel. It is not clear whether the burnishing is done with spike or by stem or leaves.

Next follows the fumigation. It is attempted with balls of stallion dung. It is first ignited and the smoke is then used in fumigating the vessel.[199]

Baking: This was primarily achieved by pit-firing. A pit, called *kūpa* or *avata*,[200] square in shape (*caturasram*) and with a wide mouth (*urubilam*) was dug into the ground. The total phenomenon, comprising the pit, fuel and pots for baking, has been best rendered by the term *āpāka*[201] which later got transformed as *āvāñ*, meaning kiln.

After digging the pit, burning materials, such as dry grass, wood, dung and, sometimes, even herbs are placed in it in a layer. According to Āśvalāyana, the materials to be used should be such which, while being burnt, dye red.[202] Then the pots are placed collectively upside down.[203] These are covered with a layer of fuel and then the entire pit, except a space of four *aṅgulas* in each direction, is covered with a plaster of wet clay,[204] evidently to conserve the heat. The open space in each direction is apparently required for lighting. Regarding the perfect baking of the pots, the texts enjoin that arrangements may be so made that the pot is baked within a day.[205] It appears that nearly twelve hours were required for the perfect baking of the pots. This sheds light on the expertise of the Vedic potters in controlling the fire in the pit to get the vessels well-fired in such a short duration.

Post-firing Treatment: Some post-firing treatment were also attempted on the pots after baking. Amongst them, sprinkling of goat's milk (*ajāpayas*),[206] while the vessels are still hot,

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has commonly been described in the Vedic texts. Sometimes cow's milk[207] is also found to be used in place of goat's milk. Evidently, the milk being sticky, may work, if sprinkled while the vessel is hot, as an useful paste in filling possible pores. In the case of minor cracks, the dust particles of the powdered stone were to be mixed with the goat's milk and filled in to the cracks, which were further to be heated with a torch.[208]

(b) Metals and Metallurgy

Another craft which evolved on the basis of thermal treatment or the *gharma* technique, initially experimented within the case of ceramics, is metallurgy, which necessitated much better knowledge of controlling fire for smelting and casting to generate plasticity in metals. There is no doubt that the Indo-Aryans were acquainted with several metals and metallurgy from the time of the writing of the Ṛgveda. The text refers to *ayas*, a term denoting metals, usually the baser ones, quite a number of times. Notwithstanding the controversy[209] about its true import, there is no denying the fact that in a number of descriptions in the Ṛgveda, it bears enough proximity with copper. Therefore, in several instances, *ayas* should be taken to imply copper rather than bronze or iron among the baser metals.

References scattered over the Ṛgveda provide evidence that *ayas* was frequently used for fashioning a variety of objects. In VI.75.15, arrows tipped with *ayas* have been mentioned. A number of passages[210] allude to *vajra*, the favourite weapon of Indra as being made of *ayas*. It was also employed for fashioning tools, such as *vāśī*[211] and *paraśu*.[212] Meanwhile, the references to *ayaso dhārā*[213] evince that the metallic implements were possessed with sharpened edges. These were employed for carving wooden objects, as is evident from the epithet *ayohata*.[214] Other items which are specifically spoken as made of *ayas* include pillars (*ayasthūṇa*),[215] vessels,[216] and armour.[217] The descriptions occurring in the text indubitably affirm that *ayas* was employed for fashioning weapons, tools and implements, posts and pillars, vessels, armour, etc. A number of passages make allusions to *āyasīḥ puraḥ*,[218] literally the settlements created of *ayas*, which indirectly reflect the strength and hardness of *ayas*. Compounds, such as *ayaḥśipra* (IV.37.4), *ayaḥ hanuḥ* (VI.71.4), and *ayaḥ śīrṣa* (VIII.101.3) also symbolically testify to the hardness of *ayas*.

Beside *ayas*, the Ṛgveda also mentions *hiraṇya*, meaning gold and *arjun* (=Avestan *erezata*, Latin *argentum*) and *rajata*, both denoting silver. The former seems to have been a widely known metal as no less than sixteen synonyms for it are found in the text.[219] It was primarily employed for making ornaments. Compared with *hiraṇya*, the references to *arjuna* or *rajata* are not so prolific, which shows that the metal was not so popular. It was perhaps because of its pronounced whiteness,[220] that silver had become a metal of attraction.

A definite stage in the advancement of the craft of metals is, however, noticed in the later Vedic literature which enumerates some new metals, including iron, in addition to those prevalent earlier. The Vājasaneyī Saṁhitā (XVIII.13) refers to *hiraṇyaṁ* (gold), *ayaḥ* (?), *śyāmaṁ* (iron), *lohaṁ* (copper), *sīsaṁ* (lead) and *trapu* (tin) in a systematic order. Obviously, the mist of doubt is still hanging over *ayas* which, instead of marking a particular metal, appears to be denoting the baser metals in general, listed after *hiraṇyaṁ* in the aforesaid passage. Nevertheless, it strikes a clear distinction between *śyāma* (literally 'black') and *loha* (literally 'red') metals, evidently on the basis of their colours which establish their identity respectively as iron and copper. The Atharvaveda (XI.3.7) classifies *ayas* into two species—*śyāma* and *lohita* which, according to Whitney, are 'iron and copper respectively'. This is further affirmed by the testimony of some other texts which refer to *loha* in contradistinction to *śyāma*[221] or to *lohāyasa* (red metal) as distinguished from *kṛṣṇāyasa* (black metal).[222] The former being red in colour is copper whereas the latter, being blackish, is iron.

Other metals which make their advent for the first time in the later Vedic literature are *kaṁsa* (bronze), *trapu* (tin) and *sīsa* (lead). Despite their late occurrence in the texts, it cannot

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be assumed that these were not known to the people in the earlier period. Vessels made of *kaṁsa*[223] and amulets and weights prepared from *sīsa*[224] have sometimes been described. Amongst all the metals known to the people, gold was still considered to be most precious. It has been stated that, as a horse signifies nobility among the animals, similarly gold occupies the most exalted status among the metals.[225]

Extraction of Ores: Very little is known from the Vedic texts about the extraction of ores. Nevertheless, there are certain allusions which suggest that the people were familiar with the metalliferous ores in the earth as well as in riverine sands. The earth has sometimes been depicted as *vasundharā, vasudhāni, hiraṇyavakṣā,* one containing wealth and gold which evinces that the metals, usually considered to be of high value, were extracted from earth. Likewise, words such as *nidhi*,[226] *khani*,[227] *khāni*,[228] and *nikhāta*[229] also suggest their collection or digging from earth. Besides, the metalliferous ores, especially of gold, were extracted from the riverine sands of the Sindhu (Indus), which is described as golden and of a golden stream.[230]

Smelting and Casting: The next step in the process consisted of purifying the ores by smelting. The Indo-Aryans were adept enough in the use of this technology from the time of the Ṛgveda as several references to root *dhmā*, 'to blow up fire', affirm. In V.9.5, a description occurs of raging fire which has been likened to one blown up by a smelter (*dhmātṛ*) in the course of melting metals. Here, the root *dhmā* has been mentioned thrice, twice as nouns (*dhmātṛ*, the blower of fire or smelter) and once as a verb (*dhamati*, the act of blowing the fire). In IV.2.17, men of noble deeds are mentioned as purifying their characters in the manner as metal is purified by the smelter. In X.72.2, the creative power of Brahmaṇaspati is compared with that of a smith (*karmāra*) who produces metallic objects by smelting the metal in fire. There are several other instances wherein the root *dhmā* signifies the power of creation, evidently by smelting.

Thus, like *gharma*, the thermic principle employed for fashioning ceramics, the technology of *dhmā* is directly linked with the control of fire. The heat of fire was gradually enhanced by passing a current of air through it with the help of certain contrivance to the extent required for melting the metal. One of these contrivances is mentioned as *dṛti*,[231] bellows made of leather which were used by the smelter to blow the fire. It has again been referred to in another passage,[232] which likens the glittering *soma* to a shining *dṛti*, presumably as the latter is always placed in the vicinity of fire. Allusion to the root *dhmā* in this context provides strength to this assumption. Apart from *dṛti* or the bellows of leather, wooden blow-pipes were also employed.[233]

After smelting, the liquified metal was put into moulds for casting to procure the desired objects. Evidence of metal casting technology is contained in the Ṛgveda and onwards in the form of the root *sic*, which means pouring as well as casting the metal. Although the root *sic* is never mentioned in the Ṛgveda in the context of a metal, some of the contexts are pregnant with important implications. Many times, it denotes the placing of creative energies, especially the procreative fluids endowed with potency, to generate new forms. This is evident from several descriptions in the text. In VI.70.2, Heaven and Earth (*rodasī*) have been invoked to 'cast' (*sic*) the procreative energies in the sacrificers for the welfare of mankind. In VI.70.3, beings of variegated forms are assumed to have been born because of the invigorating power sprinkled by Heaven and Earth. In X.61.2, procreative fluid stands differentiated from ordinary water as it is sprinkled with a certain purpose. The most eloquent description of *sic* as creative energy, manifesting itself in various forms, occurs in X.184.1 which conceives the entire creation as coming forth from the procreative seed which has been cast by Prajāpati in the womb prepared by Viṣṇu.

Thus, despite the fact that the root *sic* has never been mentioned in the Ṛgveda in reference to metal or metallic objects, it is potent with the sense of casting. It is noteworthy

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that in the Sanskrit literature of the later period, the casting of metal in moulds is likened in the Ṛgvedic fashion to 'casting' of human seed in the foetus.[234] In the light of this analogy, the references to the root *sic* in the Ṛgveda become specially meaningful as they also conceive the sense of metal casting. So far as a clear evidence of metal casting in the Vedic literature is concerned, it occurs in the Atharvaveda (XI.10.12; 13) which describes the casting of a thunderbolt (*vajraṁ yamasiñcat*) by Bṛhaspati.

NOTES AND REFERENCES

1. *Ṛgveda* X.31.7; 81.4.
2. A.A. Macdonell observes that the cosmogenic mythology of the Ṛgveda regards the universe as the result of mechanical production, the work of the carpenter's and joiner's skill. For details, see *Vedic Mythology* (1963), Indological Book House, Varanasi, p. 11.
3. Yasna 29.1; 31.11; 44.6; 51.7.
4. O. Schrader, *Pre-Historic Antiquities of the Aryan Peoples* (1962), reprint. p. 277.
5. Ibid. It is noteworthy that *drou*, 'tree' in the Greek as in the Slav means 'ancient'.
6. Kenneth P. Oakley cites several examples of the apes, especially the chimpanzees, manipulating sticks for several purposes (*A History of Technology* (eds.) Charles Singer, E.J. Holmyard, A.R. Hall, and Trevor, I. Williams (reprint, 1957), Oxford, Vol. I, pp.14-15). Elsewhere, he observes, '...we cannot estimate exactly the skill of the earliest men from the crude stone tools which are almost the only evidence of their culture, for much of their equipment may have been of wood and other perishable materials. (Ibid., p. 23).
7. Whether these are the post-holes of early man's dwellings, or the painted wooden columns of El-Amarna, the city of Ikhnaton (1350 BC), or the wooden pillars of the Mycenaean palaces at Knossos, Crete, or the columns of the wooden palace which the first Mauryan emperor built during the fourth century BC in his capital city Pāṭaliputra, all affirm that, in the beginning, the structure of dwellings, small or big was erected primarily on the wooden beams and columns.
8. In the Indian context, living specimens of imitations of wooden structures in stone have been well preserved in the rock-cut caves at Bhājā and Kārle in the western Deccan.
9. C.D. Buck, *A Dictionary of Selected Synonyms in the Principal Indo European Languages*, 1949, The University of Chicago Press, Chicago & London, 9.45.
10. *Saudhanvanāso amṛtatvamerire viṣṭvī śamībhiḥ sukṛtaḥ sukṛtyayā.*
11. *RV* I.20.1; 8; 110.4; 121.6; 7; III.60.2; IV.33.2; 34.9; 35.3; 8; 36.3; 4.
12. Ibid. X.184.1.
13. Significantly, the entire corpus of Vedic literature is replete with parallels with embryology in references to the manifestation of creative and technical skills.
14. Some equivalents of *dāru* and *dru* are the Greek *doru*, meaning tree, beam or shaft; Irish *daur*, oak; Gothic *triu*, a stick or stave of wood; Danish *troe*; Swedish *trä*; Old English *treow*; Middle English *treo, tre*, all meaning a tree or wood, Church Slavic *drĕvo*, tree, *druva* (pl.), wood; Bohemian *drĕvo*, wood, *drevno*, piece of wood; Polish *drzewo*, Russian *derevo*, both meaning tree or wood; Avestan *dāuru*, denoting a piece of wood or club. C.D. Buck, *A Dictionary of Selected Synonyms in the Principal Indo European Languages*, The University of Chicago Press, 1965, 1.42.
15. *dravirna drāvayati dāru dhakṣat*, Ṛgveda VI.3.4.
16. Taittirīya Brāhmaṇa, III.4.8.1; Śatapatha Brāhmaṇa II.2.2.13; 3.11; VI.6.3.5; XII.4.3.1.
17. Atharvaveda VI.121.2; Kāṭhaka Saṁhitā XXX.9.
18. *dārūṇi vai vānaspatyāni.*
19. *dvayāni vai vānaspatyāni cakrāṇi rathyāni cānasāni ca*, Śatapatha Brāhmaṇa V.4.3.16.
20. Taittirīya Saṁhitā VI.4.7.3; Taittirīya Brāhmaṇa. I.4.1.3-4.
21. Ṛgveda I.161.1.
22. For different interpretations see H.H. Wilson's note on the said passage.
23. Ṛgveda VIII.96.11.
24. Ibid. V.86.3.
25. Ṛgveda I.24.13; Atharvaveda VI.63.3; 84.4; 115.2-3; XIX.47.8; 50.1; Kāṭhaka Saṁhitā XXXVIII.5; Aitareya Brāhmaṇa VII.13-18; Taittirīya Brāhmaṇa II.4.4.9; Śatapatha Brāhmaṇa XII.9.2.7; etc.
26. Atharvaveda VI.115.2-3.
27. Ibid. XIX. 47.8; 50.1.

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28. It occurs twice and is explained by W.D. Whitney (*Atharvaveda Saṁhitā*, trans. VI.63.3; 84.4) as iron post. But it seems quite uncertain that *ayas* stands for iron, or, that *ayasmaye drupade* means a post fabricated entirely of iron. Use of the compound *drupada* indicates that the post consisted mainly of wood. However, it also had something metallic in it. Most plausibly, nails made of iron (?) were hammered into the wooden post to provide it with strong pegs for tying down the thief or for nailing those charged with theft or condemned to death.
29. Atharvaveda V.20.1.
30. Ibid. XI.I.12.
31. Ṛgveda VI.2.8.
32. Ibid. V.50.4.
33. Ibid. VI.44.20.
34. Ibid. VI.37.2; IX.33.2; Atharvaveda IX.3.1; 65.19; 67.14; Taittirīya Saṁhitā V.4.11.2; Taittirīya Brāhmaṇa II.4.7.2.
35. The compound *droṇakalaśa* never occurs in the Ṛgveda which mentions *droṇa* and *kalaśa* separately, and interestingly, for an identical wooden vessel. It is for the first time in the later Vedic literature that a conjoined word *droṇa kalaśa* has been evolved to distinguish the prevalent wooden type from its new ceramic version, simply known as *kalaśa*.
36. Atharvaveda IX.6.17; Taittirīya Saṁhitā IV.7.8.1; VI.3.2.3; VII.1.6.6; Śatapatha Brāhmaṇa IV.3.5.6; XI.5.5.11.
37. Ṛgveda X.44.4; Atharvaveda XX.94.4.
38. Maitrāyaṇī Saṁhitā III.4.7; Kāṭhaka Saṁhitā XXI.4; Taittirīya Saṁhitā V.4.11.2; Śatapatha Brāhmaṇa VI.7.2.8.
39. Ṛgveda VIII.46.27; X.85.20; Atharvaveda XX.131.13.
40. Ṛgveda I.121.7; 164.13; X.59.10; Taittirīya Saṁhitā VI.3.3.3; Śatapatha Brāhmaṇa III.6.4.11.
41. The Ṛgveda (X.39.12) refers to the chariot of the Aśvins as speedier than thought (*manaso javīyasā*). A fast-moving vehicle is also implied in Ṛgveda VI.75.7, which describes/depicts horses whose hooves rain dust and are neighing loudly, yoked to the chariot.
42. Ṛgveda IX.112.1.
43. Taittirīya Saṁhitā IV.5.4.2; Kāṭhaka Saṁhitā XVII.13; Taittirīya Brāhmaṇa III.4.1.2.
44. Ṛgveda I.162.6; Taittirīya Saṁhitā IV.6.8.2; Kāṭhaka Saṁhitā LVI.4.
45. Ṛgveda VIII.29.3; X.53.10; 101.10; Atharvaveda X.6.3.
46. Ṛgveda III.8.6.
47. Cf. Nirukta V.21.
48. This is probably due to the popularity of chariots in warfare and military expeditions. The importance of *rathaesta* as a militant class in the later Avestan literature coincides with the emergence of *rathakāra* in the later Vedic period.
49. Maitrāyaṇī Saṁhitā II.6.5; IV.3.8. The text states 'These [king makers] are the limbs of the king and the kingdom of that king whose *ratnins* are vigorous also become vigorous' (IV.3.8).
50. *vāśībhiḥ aśmanmayībhiḥ*, X.101.10.
51. Ṛgveda V.9.5.
52. Ibid. X.72.2. Schrader opines that the names of smiths in the IE languages are frequently derived from the old Indo-Germanic names for stone of which the smith's tools were originally made. See, *Pre-historic Antiquities of the Aryan Peoples* (reprint, Delhi, 1962). p. 100.
53. Ṛgveda I.32.5; III.2.1; Atharvaveda II.12.3; Taittirīya Brāhmaṇa II.5.4.3.
54. It is equivalent to the Greek *pelkus*, axe. Buck thinks that both of these are early loan words from a common source, represented by the Akkadian *pilakku*, Sumerian *balag*, and thus reflect a prehistoric borrowing from a non-Indo-European Asiatic source. C.D. Buck, op.cit., 9.25.
55. Ṛgveda I.30.4; III.53.22; VI.3.4; VII.104.21; X.28.8.
56. Ibid. I.127.3.
57. H. Oldenberg, *Ṛgveda Noten* I.130.
58. Ṛgveda IX.67.30.
59. Ibid. X.102.9; Atharvaveda VII.28(29).1.
60. Ibid. I.127.3.
61. Ibid. X.102.9.
62. Ibid. I.162.9; 18, 20; II.39.7; III.2.10; 8.6; 11; V.7.8; VII.3.9; VIII.102.19; IX.96.6; X.86.7; Atharvaveda. VI.141.2; IX.4.6; XII.3.33; Taittirīya Saṁhitā. VI.3.3.2; Vājasaneyī Saṁhitā II.15; V.43 etc.
63. Atharvaveda IX.4.6; XII.3.33.
64. *kṣṇotreṇeva svadhitiṁ saṁ śiśītam*, II.39.7.

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65. Ṛgveda III.2.10; V.7.8; VII.3.9; Atharvaveda VI.141.2.
66. Descriptions about creating well-made forms and trimming sacrificial posts (*yūpa*) to the geometric accuracy required an instrument capable of penetrating well in cutting mortise and tenon for fixing the ring (*caṣāla*) on the top of the post and also for projecting a number of corners both in the post and the ring.
67. It has generally been expressed by the root *vṛṣc*, to cut (Ṛgveda I.30.4; 32.5; X.28.8.; 53.9). However, some other roots, such as *han* and *vadha* which usually stand for the act of killing have also been mentioned in the sense of wood-cutting.
68. Taittirīya Brāhmaṇa II.5.5.7; Śatapatha Brāhmaṇa III.6.4.4-12.
69. *garttanvānyūpo' tīkṣṇāgro bhavati*, Śatapatha Brāhmaṇa V.2.1.7.
70. *manaso javīyasā*, Ṛgveda X.39.12.
71. Buck, op. cit., 4.12.
72. Ibid.
73. Schrader, op. cit., p. 327.
74. Buck, op. cit., 4.12.
75. *vi yo jaghāna śamiteva carmopastire pṛthivīṁ sūryāya*. Ṛgveda V.85.1.
76. Ṛgveda V.85.1; VI.8.3; VIII.6.5; Śatapatha Brāhmaṇa II.1.1.10.
77. Ṛgveda IV.13.4.
78. Taittirīya Saṁhitā VII.5.9.3.
79. Ṛgveda VIII.55.3.
80. Ibid. VIII.5.38.
81. Ibid. I.191.10; IV.45.1; 3; VIII.5.19; IX.1.8.
82. Ibid. VII.89.2; IX.1.8.
83. Ibid. IX.86.44.
84. Śatapatha Brāhmaṇa VII.5.2.35.
85. Pointing to the prevalence of a dress of sheepskin, Schrader cites the instance of the Goths who had become so habituated to clothing of hides that, no sooner did they get back from the Roman Court, where they did not dare to appear in their national garb, than they once more wrapped themselves in their sheep-skins. This was also accepted as their national garb by the Teutons, as giving evidence of the earliest recorded Teutonic times. Caesar and Sallust put down the *renones* as the national garb of the Teutons. *Pre-historic Antiquities*, op. cit., p. 327.
86. *kṛttiḥ kṛttateryaśo vānnaṁ vā*, Niruktam V.22.
87. *ye kukundhāḥ kukūrabhāḥ kṛttirdūrśani bibhrati*, Atharvaveda VIII.6.11.
88. Taittirīya Saṁhitā I.8.6.2; IV.5.10.4; Vājasaneyī Saṁhitā XVI.51; Kāṭhaka Saṁhitā IX.7.
89. Ṛgveda VI.47.26.
90. Ibid. VI.47.27.
91. Ibid. VI.75.11.
92. Atharvaveda V.21.7.
93. Ibid. VI.67.3.
94. Taittirīya Saṁhitā V.1.4.2; Taittirīya Āraṇyaka V.2.11; Śatapatha Brāhmaṇa I.1.4.1; 5.
95. Śatapatha Brāhmaṇa, III.9.1.12.
96. Vājasaneyī Saṁhitā XXX.15; Taittirīya Brāhmaṇa III.2.13.1.
97. *Vedic Index*, I.14.
98. Ṛgveda II.3.10; III.4.10; VII.2.10, etc.
99. Ibid. V.85.1; VI.8.3; VIII.6.5; etc.
100. Ṛgveda X.27.22; Atharvaveda I.2.3.
101. Ṛgveda IV.57.4.
102. Ibid. X.60.8.
103. Ibid. X.101.6; 7.
104. Ibid. IV.13.4.
105. Ibid. VII.47.26; 27.
106. Atharvaveda V.20.1; 21.3.
107. Āpastamba Śrautasūtra XVIII.18.6; XX.17.8.
108. Ṛgveda I.162.9.
109. Ibid. I.162.10; II.3.10.
110. Ibid. I.162.20; X.79.6.
111. Atharvaveda X.1.20.

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112. *Svadhiti* was also used in wood work by the carpenter.
113. Ṛgveda I.162.9; 18; 20; Vājasaṅeyī Saṁhitā II.15.
114. Ibid. II.32.4.
115. Some of these are Italian *tessere*, French *tisser*, Spanish *tejer*, and Rumanian *tese*.
116. Walde-Pakorny as quoted by Buck, op. cit., 6.33.
117. Atharvaveda XVIII.4.31; Taittirīya Brāhmaṇa I.3.7.1; Śatapatha Brāhmaṇa V.3.5.20.
118. V.S. Pathak, *Man and Environment*, XVII(1)-1992, p.88.
119. *Vedic Index*, II.60.
120. Śatapatha Brāhmaṇa V.2.1.8.
121. Ṛgveda X.85.34; Atharvaveda XIV.2.41.
122. Ṛgveda I.92.4; 5; II.3.6.
123. Ibid. X.136.2.
124. Atharvaveda I.17.1.
125. *rūpaṁ vā etat puruṣasya yad vāsas.*
126. Ṛgveda VIII.67.3; X.75.8.
127. A passage describing spinning (*akṛntan*), weaving (*vayan*) stretching (*tatnire*) and making of a garment (*vāsa*) is also found in the Atharvaveda XIV.1.45.
128. Ṛgveda I.164.5; VI.9.2.; 3.
129. Taittirīya Saṁhitā VI.1.1.4.
130. Ṛgveda VII.93.3; X.130.2; Atharvaveda X.7.42 etc.
131. *tantrameke yuvatī virūpe abhyākrāmaṁ vayataḥ ṣaṇmayūkham. Prānyā tantūnstirate dhatte anyānāpa vṛṅjāte na gamāto antam.*
132. *vastrā putrāya mataro vayanti.*
133. *tad vā etat strīṇāṁ karma yadūrṇāsūtram karma*, Śatapatha Brāhmaṇa XII.7.2.11.
134. Atharvaveda XIX.58.4.
135. Ṛgveda I.31.15.
136. Ibid. II.32.4.
137. To Yāska, *peśa* is a synonym of beauty (*peśa iti rūpa nāma*). Nirukta 8.11.
138. Vājasaneyī Saṁhitā XXX.9, Taittirīya Brāhmaṇa III.4.5.1.
139. Vājasaneyī Saṁhitā XXX.12, Taittirīya Brāhmaṇa III.4.7.1.
140. Taittirīya Brāhmaṇa III.4.5.1.
141. Vājasaneyī Saṁhitā XXX.8.
142. Ibid. XXX.7, Taittirīya Brāhmaṇa III.4.3.1.
143. Ibid.
144. *Vedic Index*, II, 476.
145. Ṛgveda II.24.7; V.30.4; X.67.3.
146. Ibid., IV.30.20.
147. Ibid. II.14.6; 30.5; V.54.3; VII.104.5.
148. Ibid. X.101. 10.
149. The term has been derived from the Greek root *kerannumi*, meaning to mix and mingle. Apart from denoting the diluting of wine with water (Odyssey 5.93; 24.364 etc.), the root also stands for mixing and kneading of clay and consequently, for several things related to the potter's craft. This is explicitly evident from several derivatives of the root *kerannumi*, such as *kermos*, potter's earth or clay; *kerāmeia*, potter's craft, *kerameion*, potter's workshop, etc. Descending from a tradition of high antiquity, the Greek *kermos*, which has its equivalent in the Latin *ceramicus*, undoubtedly conveys an earliest sense when kneading the clay with certain ingredients to make it suitable for fashioning the pots was considered immensely essential in comparison to their modelling or baking.

A parallel tradition, related to the mixing or kneading of clay, is also noticed in the Indo-Iranian literature. This is being represented by the Sanskrit root *śṛṇāti* (= *śrī*) the Avestan *sara* (Bartholomae as quoted by Erach J.S. Taraporewala, *The Divine Songs of Zarathushtra*, 1951, Bombay, p. 258), both meaning to mix. As in early Greek, the roots express the mixing of liquids, especially *soma* or cow-products, to be offered as oblation to gods. The notable evolutes of *śṛṇāti-śrī* are *śarma* and *śaraṇa* which denote in the Ṛgveda dwellings or houses made of clay. These are comparable to the Avestan *saram* (*Yasna* 41.6) and *saramno* (*Yasna* 49.5-8;53.3) which possesses almost a similar sense.

Thus, we notice a two-dimensional proliferation in the meaning of the roots, Greek *kerannumi* and Vedic Avestan *śṛṇāti-sara*. Originally denoting the mixing of liquids, these came to be associated with the mixing of clay and, eventually, to the fashioning of earthen pots or clay-made dwellings. In the Greco-

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Latin it became completely identified with pottery whereas in the Indo-Iranian, it signified dwellings made of clay at a very early stage.

150. O. Schrader op. cit., p. 367; C.D. Buck, op. cit., 5.26.
151. Ṛgveda X.87.4; Atharvaveda IV.6.7; V.18.15; VIII.3.6.
152. Śatapatha Brāhmaṇa VI.7.1.15; 16; 20.
153. C.D. Buck, op. cit., 5.25.
154. Ibid. 5.26.
155. Ṛgveda I.162.13; X.86.18.
156. Ibid. IX.52.3.
157. Ibid. X.167.5.
158. A.A. Macdonell and A.B. Keith *Vedic Index* (2 vols.), reprint, Varanasi, 1958, Vol. I, p. 256.
159. Vājasaneyī Saṁhitā XIX.37; Śatapatha Brāhmaṇa V.5.4.27; 28; XII.7.2.13; 8.1.8.
160. Ṛgveda, IX.86.16; 96.9.
161. *kalaśaṁ caturbilam*, Atharvaveda XVIII.4.30.
162. *Nirukta*, X.44. See also Sāyaṇa on Ṛgveda I.95.8; 186.5; IV.19.4; etc.
163. Atharvaveda X.8.9.
164. A potter's wheel was very much in vogue, as is evident from the reference to *kaulālacakram* in the Śatapatha Brāhmaṇa XI.8.1.1.
165. Kātyāyana Śrauta-Sūtra XXVI. 1.5.
166. Taittirīya Saṁhitā V.1.6.2; 3.
167. *armakapālaiḥ śarkarābhirvāñjanapiṣṭābhiḥ* ... Baudhāyana Śrauta-Sūtra on the *Agnicayana* text ed. By W. Caland, trans. By Yasuke Ikari and Harold Arnold, *Agni: The Vedic Ritual of the Fire Altar*' (ed.) Fritz Staal, Delhi, 1984, Vol. II, pp. 492 ff.
168. Śatapatha Brāhmaṇa XIV.1.2.10-12; Kātyāyana Śrauta-Sūtra. XXVI. 1.3.
169. Śatapatha Brāhmaṇa VI.5.1.1-6; Kātyāyana Śrauta Sūtra XVI.3.16-20.
170. *teṣāṁ cūrṇaiḥ saṁsṛjati*, XVI.3.20.
171. Śatapatha Brāhmaṇa VI.5.1.1; 4; 6 etc.
172. *athāsya veṇukāṇḍena dvibhāgam avavidhyati*. Baudhāyana Śrauta Sūtra, as quoted by Ikari Yasuke, Agni, op. cit., Vol. II. p. 172. See also Eggeling *SBE*, Vol. XLIV, p. 454, fn.3.
173. Śatapatha Brāhmaṇa VI.5.2.4.
174. Ibid. VI.5.2.3. See also Kātyāyana Śrauta Sūtra XVI.3.26.
175. *athāsyai sarvvastīramunnayati*, Ibid.
176. Kātyāyana Śrauta Sūtra, XVI.3.29.
177. Śatapatha Brāhmaṇa VI.5.2.7.
178. Atharvaveda X.8.9; XI.3.18; XVIII.4.30; Taittirīya Saṁhitā I.6.1.2; Kāṭhaka Saṁhitā V.6; XXXII.6. Taittirīya Brāhmaṇa III. 7.4.16; etc.
179. Śatapatha Brāhmaṇa IV.3.1.7; XIV.1.2.17.
180. Atharvaveda XI.3.18; Taittirīya Saṁhitā I.6.1.2; Kāṭhaka Saṁhitā V.6; XXXII.6.
181. Atharvaveda XVIII.4.30; Taittirīya Brāhmaṇa III.7.4.16.
182. Ibid. X.8.9.
183. *ubhayato mukhābhyām pātrābhyām*, Śatapatha Brāhmaṇa VI.5.2.16; *SBE*, Vol. XLI. p.237.
184. Ibid. XIV.1.2.17.
185. Ibid. VI.5.2.18; Taittirīya Saṁhitā V.I.6.4.
186. Taittirīya Saṁhitā V.I.6.4; Baudhāyana Śrauta Sūtra X.5.
187. Ṛgveda I.162.13.
188. Atharvaveda XI.3.11.
189. *Potteries in Ancient India*, (ed.) B.P. Sinha, Patna, 1969, p. 306.
190. Śatapatha Brāhmaṇa VII.4.2.1; 2;3; etc.
191. Ibid. V.4.4.1.
192. Ibid. IV.6.1.2.
193. See Eggeling's Note 1 on Śatapatha Brāhmaṇa IX.3.4.4, in *SBE* Vol. XLIII, p. 224.
194. Śatapatha Brāhmaṇa VI.5.2.11.
195. Ibid. VI.5.2.14.
196. Taittirīya Saṁhitā V.1.6.4.
197. *pravāte pratilepamupavātayati*, Baudhāyana Śrauta Sūtra. *Agni*, op. cit., Vol. II, p. 494.
198. Śatapatha Brāhmaṇa XIV.1.2.19.
199. Baudhāyana Śrauta-Sūtra, *Agni*, op. cit., vol. II. p. 494.

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200. The Śatapatha Brāhmaṇa (VI.5.4.1) refers to it as *kūpa*, but in the Śrauta Sūtras, it has often been called *avata*. Obviously, both the terms mean pit or well. In the context of baking pots, the depth and dimension of the pit depended on the number of pots to be baked.
201. See Hari Swami, the Commentator on the Śatapatha Brāhmaṇa XIV.1.2.21. Also see commentaries of Karka and Yājñikadeva on Kātyāyana Śrauta Sūtra XXVI. 1.1; 25.
202. Āśvalayana Śrauta Sūtra, XV.3.20.
203. This conceives well the process of inverted firing, considered to be a peculiarity of Black-and-Red Ware in the archaeological sources. It was undoubtedly prevalent among the Indo-Aryans.
204. Baudhāyana Śrauta Sūtra, *Agni*, op. cit., Vol. II, p. 494.
205. Śatapatha Brāhmaṇa VI.5.4.10; XIV.1.2.21.
206. Taittirīya Saṁhitā V.I.7.4; Śatapatha Brāhmaṇa VI.5.4.16; XIV. 1.2.25; Kātyāyana Śrauta Sūtra XVI.1.26; XVI.4.23.
207. Baudhāyana Śrauta Sūtra, quoted in *Agni*, op. cit., Vol. II. p. 496.
208. Ibid.
209. To Gordon Childe, *ayas* meant copper (*The Aryans*, 1926, p. 29 n). Zimmer took it for bronze (*Vedic Index*, op. cit., I.31). Monier Williams translates *ayas* as iron metal, an iron weapon, gold and steel (*A Sanskrit-English Dictionary*, 1960, p. 85). Scholars such as M.N. Banerjee (On Metals and Metallurgy in India, *IHQ*, Vol. III, 1927, pp. 16ff; Iron and Steel in the Rigvedic Age, *IHQ*. Vol.V, 1929, pp. 432ff; etc.) L. Gopal (Antiquity of Iron in India, *Uttar Bharati*, Vol. IX, No.3 pp. 71-86), and N.R. Banerjee (*Iron Age in India*, 1965, pp. 158-60) have taken it for iron.
210. Ṛgveda I.52.8; 80.12; 81.4; 121.9; VIII.96.3; X.48.3; 96.3; 4; 113.5; etc.
211. Ibid. VIII.29.3.
212. Ibid. X.53.9.
213. Ibid. VI.3.5; 47.10.
214. Ibid. IX.1.2; 80.2
215. Ibid.V.62.7; 8.
216. Ibid. V.30.15.
217. Ibid. I.56.3; X.101.8.
218. Ibid. II.20.8; IV.27.1, VII.15.14; 95.1; etc.
219. See, Nirukta, 2.10
220. This has been referred quite a number of times. See Ṛgveda I.122.5; III.39.2; VI.9.1; VII.55.2; VIII.25.22; IX.69.4; X.21.3.
221. Taittirīya Saṁhitā IV.7.5.1.
222. Taittirīya Brāhmaṇa III.6.6.5.
223. Atharvaveda XX.5.
224. *Vedic Index*, II, 452.
225. Śatapatha Brāhmaṇa XIII.2.3.17.
226. Ṛgveda VII.67.7, X.108.7
227. Ibid. I.179.6; VII.49.2.
228. Ibid. II.15.3; IV.28.1; V.32.1; VII.82.3.
229. Ibid. I. 117.5; 12; VIII.66.4.
230. *Vedic Index, hiraṇya*, II.504.
231. Ṛgveda VII.89.2.
232. Ibid. IX.1.8.
233. Ibid. I.85.10.
234. A description in the Aśvamedhika Parva of the Mahābhārata expresses it thus:

yathā lohasya niḥsyando niṣikto bimbavigraham/
upaiti tad vijānīhi garbhe jīvapraveśanam//...9
lohapiṇḍaṁ yathā vanhiḥ praviśya hyatitāpayet/
tathā tvamapi jānīhi garbhe jīvopapādanam//... 10

'As liquified iron, poured (into a mould), takes the form of the mould, know that the entrance of Jīva into the foetus is even such. As fire, entering a mass of iron heats it greatly do thou know the manifestation of Jīva in the foetus is such'.

A similar allusion is also noticed in the third Chapter of the Śarīrasthāna of the Caraka Saṁhitā.

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APPENDIX

1. *Sthālī* is elaborately dealt with on pp. 169-73 of the author's *Technology in Vedic Literature* with the proposition that it was originally a dish-on-stand. Later on, when the vessel got employed for purposes other than the ritual cooking, the stand was removed confining it only to a dish.

2. The later Vedic literature is replete with references to *sthālī* and *camasa*, the dishes and bowls, which happen to be the characteristic pottery-types of the PGW assemblage. On p. 538 of the chapter, reference has specially been made to two notable features of the *camasa-tiryagbilah*, 'the slanting channel' and *ūrdhvabudhnah*, the upraised base, which are comparable to lipped and footed bowls respectively of the PGW assemblage (*Technology in Vedic Literature*, p. 183). Some other grounds for this correlation are the unambiguous allusions in the literature of the later Vedic period to iron and to the mixing of ingredients, such as *ajāpayas* (goat's milk), *ayorasa* (iron-rust) etc. (ibid., p. 193) into the soils to be used for making pots—the latter indubitably reflecting an evolved technique of fashioning ceramics which is also evident in the case of PGW.

3. Reasons for assuming some of the Vedic pottery-types, such as *kumbha, kalaśa, caru, sthālī, camasa*, etc., as wheel-made are:

Firstly, these are never mentioned as handmade. Had it been so, the Vedic literature, which deals extensively with the techniques of fashioning handmade pots, would have never minced words about them. Secondly, the number of all these types of pots is so large that it seems unimaginable that all these would have been made by hand. Thirdly, apart from being ritualistic pots, most of these were equally employed in daily use for cooking, storage and drinking and anticipate a certain degree of perfection in their fashioning which is generally unlikely to have been obtained if these were handmade, and the number was vast. And, fourthly, the reference to *kaulālacakram*, the potter's wheel in the Śatapatha Brāhmaṇa (XI.8.1.1) leaves no doubt that the pots were prepared on a wheel.

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Note—For original Vedic texts see Bibliography to Chapter XIX

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CHAPTER XXV

Foundations of Indian Mathematics and Geometrical Ideas in the Śulba Sūtras

S.A. Paramhans

I. INTRODUCTION

The richness of the cultural tradition of a country or of a race leans heavily upon the development of science and technology in it and this development depends upon the treasure of mathematical knowledge and its applications in the various spheres of public and personal life. Hence, we can safely say that, to measure the development of a race or a country during a certain period, its development in mathematics can be taken as a good indicator. Perhaps, this is why L. Hogben[1] chose, 'Mathematics, the mirror of Civilization', as the title of the opening chapter of his book, *Mathematics for the Million.*

Thus to ascertain the past culture and development of India it is essential to trace the contribution of the savants of this country in the field of mathematics.

FOUNDATIONS OF INDIAN MATHEMATICS

The opening mantras of the Ṛgveda[2] and of the Sāmaveda[3] both begin with *Agni* and contain descriptions of *yajña* (Vedic sacrifice to fire). This indicates the vitality of *yajñas* in the life of the ancient Hindus. So it is said, '*Vedā hi yajñārthamabhi-pravṛttāḥ*'.[4] The sacrifice was to be performed on altars of definite shape and size. Definiteness in shape and size was achieved by arranging and counting the bricks constituting the altar. This is thus indicated in the Kaṭhopaniṣad:[5]

Lokādimagniṁ tamuvāca tasmai
Yā iṣṭakā yāvatīrvā yathā vā

Here, *yāvatīrvā* indicates the number and *yathā vā* indicates the manner of arrangement of the bricks. This shows that the counting process in ancient Indian culture is at least as old as the *yajñas.* Rather, some savants opine that it is older than the *yajñas* themselves, since the application of a scientific process presupposes its prior mastery. It was a part of education in ancient India as is clearly indicated by the Nārada-Sanatkumāra dialogue of the Chāndogya Upaniṣad.[6] Here Nārada's list of subjects presented to Sanatkumāra includes *rāśi* (= mathematics) and *nakṣatra vidyā* (= astronomy).

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As is well known, Vedic sacrifices were of different types. Some of them were obligatory on every Vedic Hindu. These were called *nitya* or indispensable. Some others were optional or *kāmya*. Although the altar associated with a particular sacrifice was of a definite shape and size, various kinds of sacrifices needed varieties of altars. *Nitya* altars were primarily classified in three groups, namely *Gārhapatya*, *Āhavanīya* and *Dakṣiṇa*. According to the instructions of one school, the *gārhapatya* altar was square in form but the same was described as circular by another school. The altar for the *āhavanīya* fire was always square and that for *dakṣiṇāgni* was semi-circular.[7] The area of all the three altars was required to be one square *vyāma* [1 *vyāma* = 96 *aṅgulas* (finger breadths)]. Thus, geometrical constructions and arithmetical calculations were involved in the construction of altars. On some occasions, it was needed to transform a square altar into a rectangular one (whose one side is given) without changing its area. This forced the worshippers to solve linear algebraic equations (in one unknown). Thus we see that the Hindu ritual *yajña* explicitly laid the foundation stone of the Mathematical sciences: Geometry, Arithmetic and Algebra. Later, these three sciences grew up as independent disciplines in Hindu culture and were cultivated for their own sake by the ancient Hindus.

Historically, ancient Indian mathematics can be viewed as follows:

1. Vedic period: Antiquity – 1200 BC.
2. Vedāṅga period: 1200 BC – 500 BC.
3. 'Dark' period: 500 BC – AD 500.

Vedic Period

The most remarkable contributions of this period are the concepts of numerals and zero.

Vedāṅga Period

During this period the contributions were mostly in the field of geometry and astronomy.

Dark Period

The 'darkness' of this period refers to the fact that, except for Jaina *Gaṇitānuyoga* works and the Bakṣālī manuscript, no other Hindu mathematical work belonging to this period has been found so far. However, in the treatises, *Sūryaprajñapti* and *Candraprajñapti* which belong to *Gaṇitānuyoga* of the Jainas, we find some important contributions, the treatment of the ellipse being one of them. It is noteworthy here that the credit of inventing the ellipse has been wrongly attributed to the Greek geometer Menaechmus (350 BC).[8] But prior to 350 BC, it is mentioned in *Sūryaprajñapti* (500 BC)[9] and *Dhammasangani* (350 BC).[10] *Dhammasangani* uses the term *parimaṇḍala* for it, as did the Śatapatha Brāhmaṇa (6.7)[11] and the *Bhagavati Sūtra*,[12] a Jaina work of 300 BC where it has been classified in two ways, namely *Pratara parimaṇḍala* (plane eclipse) and *ghana parimaṇḍala* (ellipltical cylinder).

Mathematics as Vedāṅga

The following verse of the Vedāṅga Jyotiṣa is quoted very often in support of the fact that mathematics was held in high esteem in ancient Hindu culture:

Yathā śikhā mayūrānām nāgānām manayo yathā.
Tadvadvedāṅgaśāstrānām gaṇitam mūrdhani sthitam.[13]

Obviously, we can draw two conclusions from this verse:

(*a*) that gaṇita was considered to be one of the *Vedāṅga-śāstras*; and
(*b*) that it held the highest position among the *Vedāṅga-śāstras*.

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It should be noted here that the *Vedāṅgas* (limbs of the Veda) were intended to help in a proper understanding, interpretation and application of the Vedic hymns. To this end they expounded[14] *śikṣā* (phonetics), *kalpa* (ritualistics), *vyākaraṇa* (grammar), *nirukta* (etymology), *chandas* (prosody), and Jyotiṣa (astronomy and astrology). *Śikṣā* was compared to the nose, *vyākaraṇa* to the mouth, *chandas* to the legs, *nirukta* to the ears, *kalpa* to the hands and *jyotiṣa* to the eyes of the personified Veda.[15] The first four organs were meant for appropriate recitation and interpretation of the Vedic hymns while *kalpa* gave rules and regulations regarding Vedic rituals and provided the code of conduct for society. The appropriate times for rituals and for various private and public affairs was decided by *jyotiṣa*, which also indicated the astral motions and their consequences at a particular time on any individual or group.

It is to be noted that the list of Vedāṅgas given by the *Muṇḍakopaniṣad* does not seem to include *gaṇita*. In this connection, it should be noted here that in and up to the period of the Vedāṅga Jyotiṣa there was an integrated subject which was sometimes called *gaṇita* and sometimes astronomy. So '*Gaṇitam mūrdhani sthitam*' is quite maintainable. But in the later Vedic period, when the integrated subject *Jyotiṣa* or *Gaṇita* developed, it was divided, as is witnessed in the Chāndogya Upaniṣad. (7.1.2, 7.2.1) into three branches: *rāśi vidyā* (arithmetic), *nakṣatra vidyā* (astronomy) and *daiva vidyā* (astrology). Later on, *rāśi vidyā* initiated the process of *iṣṭakarma* which, when developed, took the form of *kuṭṭaka, avyakta gaṇita* or *bījagaṇita*. Further, as has already been said, *kalpa* dealt with rules and methods for performing rituals and ceremonies. They fell into three categories: *śrauta, gṛhya* and *dharma*. The *Śulba* Sūtras form the subcategory of *Śrauta* sūtras and deal with the geometrical mensurations and constructions related to fire altars. In the later period, *śulba* was separated from *kalpa*. So in the later Vedic period, *pāṭīgaṇita* (arithmetic) and *bījagaṇita*, which were separated from astronomy and were combined with *śulba vijñāna* (geometry) (which was separated from *kalpa*) to form an independent discipline, the mathematics of later times. It consisted of the following subtopics: *parikarma* (fundamental operations), *vyavahāra* (practical arithmetic), *rajjū* (geometry), *rāśi* (rule of three), *kalāsavarṇa* (factions), *yāvattāvat* (simple equations), *varga samīkaraṇa* (quadratic equations), cubic equations, *varga-varga* (biquadratic equations), *vikalpa* (permutation and combination). This is indicated by the Jaina *Sthānāṅga Sūtra*[16] (350 BC):

> *parikammam vavahāro rajjū rāśi kalāsavanneya*
> *jāvantāvati vaggo ghano tataho vaggāvaggo vikappota*—(Sūtra 747)[17]

Information can also be found in the Arthaśāstra[18] of Kauṭilya belonging to the period of Candragupta Maurya (322 BC). Here we find the problems concerning taxation, debt and interest, partnership, barter and exchange, etc.

GEOMETRICAL IDEAS IN THE ŚULBA SŪTRAS

When geometry developed as an independent discipline, there grew several schools of geometry, each having its own manual bearing its name. These manuals were called śulbasūtras. Ten śulbasūtras are now available: Baudhāyana, Āpastamba, Kātyāyana, Mānava, Satyāṣāḍa, Maitrāyanī, Varāha, Vadhula, Maśaka and Hiraṇyakeśī. The first four schools and their respective śulbasūtras are notable and were published by the Indian National Science Academy[19] in 1984. Thus the earliest name for geometry in India was *śulba*, which means rope. It is also called *rajjū* which means a cord. Both names carry a sense of measuring (something), or the act of measurement or an instrument of measurement, or a (assigned) unit of measurement. More precisely, it was called *Śulba-Vijñāna* (i.e. the science of rope). Later on, it was known as *kṣetragaṇita*.

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In the construction of the three types of altars mentioned in the beginning of this paper, there arose mainly three geometrical problems:

(*i*) to construct a square on a given straight line;
(*ii*) to circle a square and vice-versa; and
(*iii*) to construct circles having areas twice, thrice and four or five times the area of a given circle.

The last problem involved evaluation of the surds $\sqrt{2}$, $\sqrt{3}$ and $\sqrt{5}$.

Owing to variations in the targets, there were altars of other shapes for *kāmya* sacrifices, e.g., the shape of a falcon with straight or bent wings, equilateral triangles, isosceles trapeziums, wheels (with or without spokes), circles, tortoise shapes, trough shapes etc. The measurements and the shapes of various type of altars are given in Table 1, which is based on the table by Bag.[20] (reference no. 21 has been cited at the end of Table 1)

Measurements of some other important Vedīs prescribed by the Baudhāyana and Āpastamba are also mentioned by Sen-Bag.[22] In further steps, at each subsequent construction of an altar, it was required to increase its size by a specified amount, often by one square *puruṣa*, retaining the shape of the first construction. Thus ancient Hindus faced the problem of the equivalent areas and transformation of areas.

Construction of altars required a good deal of knowledge of the properties of squares, rectangles, rhombuses, trapeziums, triangles and circles and involved constructions, of which a few are mentioned here:

1. To divide a line into a given number of equal parts.[23]
2. To divide a circle into any number of equal areas by drawing diameters.[24]
3. To divide a triangle into a number of equal and similar areas.[25]
4. Drawing a perpendicular at a given point of a line.[26]
5. Drawing a rectangle of given sides.[27]
6. Construction of a square of a given side.[28]
7. Construction of a square equivalent to a given rhombus.[29]
8. Construction of a rhombus equivalent to a given square or triangle.[30]
9. Construction of a square equivalent to a given isosceles triangle.[31]
10. Transformation of a square into an isosceles triangle.[32]
11. Transformation of a square into an isosceles trapezium having a given face.[33]
12. Transformation of a square into a rectangle having a given side.[34]
13. Transformation of a square into a circle[35] and *vice versa*.[36] (A detailed account of squaring a circle may be seen in an article of T. Hayashi.)[37]
14. Transformation of a rectangle into a square.[38]
15. Transformation of a triangle into a square.[39]
16. Construction of a pentagon.[40]
17. Construction of a square equal to the sum of two different squares.[41] It paved the way to the construction of a square equivalent of two given triangles.
18. Construction of an isosceles trapezium.[42]

These constructions require a knowledge, explicit or implicit, of certain important theorems. Some of these are stated here:

1. In an isosceles triangle the line joining the vertex to the middle point of the base divides it into two equal parts.[43]
2. The diagonals of a rectangle bisect each other. The rectangle is divided by these into four parts. The two horizontal parts as well as the two vertical parts are identical.
3. The diagonals of a rhombus are perpendicular bisectors of each other.

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Table 1: Altars of Various Shapes

Altar	Shape/Horizontal Section	Area	Reference*	Desired Objective
I. Perpetual Fire Altars				
(i) Āhavanīya	Square	One sq. Vyāyāma	B.S. 3.1-5; 7.4; 7.5	
(ii) Gārhapatya	Circle, Square	One sq. Vyāyāma	B.S. 7.5; Āp.S. 7.3	
(iii) Dakṣiṇāgni	Semi-circle	One sq. Vyāyāma	Śatapatha Brāhmaṇa (see ref.7)	
II. Vedīs				
(i) Mahāvedī or Saumikya vedī	Isosceles trap	972 sq. padas	B.S. 4.3	
	a=face=24 padas	—		
	b=base=30 padas	—	Āp.S. 5.1-8	
	c=height=36 padas	—	K.S. 2.11; 2.12	
(ii) Sautrāmaṇi Vedī	Isosceles trap. ($a = 24/\sqrt{3}$; $b = 30/\sqrt{3}$ $c = 36/\sqrt{3}$) or ($a = 8\sqrt{3}$, $b = 10\sqrt{3}$, $c = 12\sqrt{3}$)	324 sq. padas	K.S. 2.11; 2.12	
(iii) Paitṛkī Vedī	(*i*) Isosceles trap $a = 8$; $b = 10$; $c = 12$ (*ii*) A square having four corners in four coordinate directions	108 sq. padas	B.S. 3.11-13	
III. Optional Fire Altars				
(i) Caturasra Śyena	hawk bird with sq. body, sq. wings and sq. tail	7.5 sq. puruṣa	B.S. 8.1-19; 9.1-10 Āp. S. 15.1-16.1	Heaven
(ii) Vakrapakṣa vyastapuccha śyena	hawk bird with bent wings and outspread tail	7.5 sq. puruṣa	B.S. 10.1-20; 11.1-13	Heaven
(iii) Kaṅkacit	hawk bird with curved wings and tail	7.5 sq. puruṣa	B.S. 12.1-8; Āp.S. 21.1-9	Heaven
(iv) Alājacit	Alāja bird with curved wings and tail	7.5 sq. puruṣa	B.S. 13.1- 6; Āp.S. 21.1	Desiring support from heaven
(v) Prauga	Triangle	7.5 sq. puruṣa	B.S. 14.1-8; Āp.S. 12.4-10	Annihilation of rivals
(vi) Ubhayataprauga	Rhombus	7.5 sq. puruṣa	B.S. 15.1-6; Āp.S. 12.1-10	Annihilation of rivals
(vii) Rathacakracit	Circle	7.5 sq. puruṣa	ref. 47; 5.4.11.1-3	Annihilation of rivals
(viii) Droṇacit	Trough	7.5 sq. puruṣa	B.S. 17.1-12; 18.1- 15; Āp.S. 13.4-14	Gaining food
(ix) Śmaśānacit	Isosceles trap	7.5 sq. puruṣa	B.S. 19.1-11; Āp.S. 14.7-14	Attaining the place where forefathers have gone (*Pitṛloka*)
(x) Kūrmacit	Tortoise	7.5 sq. puruṣa	B.S. 20.1-21; 21.1-13	

*Śulbasūtra numbers are as in reference 19.

For the source of these altars, the *Śulbakāras* use the term *vijñāyate* (known as per tradition), *vedairvijñāyate* (known as per Vedic traditions), etc., very often.[21]

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4. A rectangle and a parallelogram on the same base and having the same height, have the same area.
5. The areas of the squares produced separately by the length and the breadth of a rectangle together equal the area of the square produced by the diagonal.[44]
6. A quadrilateral obtained by the lines joining the middle points of the sides of a rectangle is a rhombus whose area is half of that of the rectangle.
7. The area of the square formed by joining the middle points of the sides of a square is half of that of the original one.

Theorem 5 above, though initiated by śulbakāras before 800 BC does not bear the appropriate name, 'Śulba Theorem' but is today universally associated with the Greek Pythagorus (540 BC) though, according to Heath[45] no really trustworthy proof exists that it was actually discovered by him. As J.N. Crossley points out, according to the *Oxford Classical Dictionary* [b] 'Pythagorus wrote probably nothing (although works were later fathered on him) and already in Aristotle's day his life was obscured by legend.'[46]

Particular examples of this theorem date back to the Taittirīya Saṁhitā[47] where we find $(39)^2 = 36^2 + (15)^2$.

Approximations for Surds and Π

Often it was needed to draw a circle having double the area of a given circle. This involved evaluating the surd $\sqrt{2}$. Baudhāyana gave the approximation of this surd as:

Pramāṇam tṛtīyena vardhayettacca
caturthenātmacatustrimśonena saviśeṣaḥ[48]

This gives the value of the surd as:

$$\sqrt{2} = 1 + \frac{1}{3} + \frac{1}{3 \times 4} - \frac{1}{3 \times 4 \times 34}$$
$$= 1.4142156$$

which is correct upto five places of decimals (the modern value being (1.414213). The same approximation has been given by Āpastamba.[49]

Among other important contributions of ancient Indian mathematics, a remarkable achievement is the approximation for π, the ratio between the circumference and the diameter of circle. As has been mentioned earlier, it was one of the important constructions required to transform a square altar into a circular one. It necessitated the determination of the ratio π. A rough value of this ratio is found in the Mahābhārata[50] as follows:

Swarbhānoḥ Kauravaśreṣṭha yāvadeva pramāṇataḥ
parimaṇḍalo mahārāja swarbhānuḥ śrūyate grahaḥ
Yojanānām sahasrāṇi viṣkambho dvādaśāsya vai
pariṇāhena ṣaṭṭriṁśad vipulatvena cānagha
Ṣaṣṭhimāhuḥ śatānyasya budhāḥ paurāṇikāstathā
Candramāstu sahasrāṇi rājannekādaśa smṛtaḥ
Viṣkambhena kuruśreṣṭha trayastriṁśattu maṇḍalam
Ekonaṣaṣṭiviṣkambham śītarasmermahātmanaḥ
Sūryastvaṣṭau sahasrāṇi dve cānyekurunandana
viṣkambhena tato rājan maṇḍalam triṁśatā samaṁ
Aṣṭapañcāśatam rājan vipulatvena cānagha
śrūyate paramodāraḥ patagoasau vibhāvasuḥ.

This gives the data for diameter and circumference of the planets in yojanas as follows:

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Graha	*Diameter*	*Circumference*
Rāhu	12000	36000
Moon	11000	33000
Sun	10000	30000

This clearly tells that $\pi = 3$. Baudhāyana[51] gives the same value. A more accurate value of π is given by Baudhāyana in the sūtra:

Maṇḍalam caturasram cikīrṣanviṣkambhamaṣṭau
bhāgānkṛtvā bhāgamekonatriṁṣadha
vibhajyāṣṭāviṁśatibhāgānuddharet bhāgasya
ca ṣaṣṭhamaṣṭamabhāgonam.[52]

which means

$$\pi = 4\left(1 - \frac{1}{8} + \frac{1}{8 \times 29} - \frac{1}{8 \times 29 \times 6} + \frac{1}{8 \times 29 \times 6 \times 8}\right) = 3.0885$$

However, the Mānava śulbasūtra[53] gives a slightly different value as follows:

$$\begin{aligned} \text{Circumference} &= \frac{\text{diameter}}{5} + 3 \times \text{diameter} \\ &= 3.2 \times \text{diameter} \\ \text{so } \pi &= 3.2 \end{aligned}$$

According to the Sūryaprajñapti[54] (sūtra 20) of the Jainas we have $\pi = \sqrt{10}$. Āryabhaṭa I gave the best approximation of his time which is as follows:[55]

$$= \frac{62832}{20000} = 3.1416$$

Construction of the fire altars as well as their placement in connection with the arrangement of the sacrificial fires required linear measurements and measurements of area. So units for these measurements were ascertained by the śulbakāras as follows:[56]

1 *aṅgula*	=	14 *aṇus* (grains of *Panicum milliaccum*) = 34 tolās
1 Small *pada*	=	10 *aṅgulas*
1 *prādeśa*	=	12 *aṅgulas*
1 *pada*	=	15 *aṅgulas*
1 *īṣā*	=	188 *aṅgulas*
1 *akṣa*	=	104 *aṅgulas*
1 *yuga*	=	86 *aṅgulas*
1 *jānu*	=	32 *aṅgulas*
1 *samyā*	=	36 *aṅgulas*
1 *bāhu*	=	36 *aṅgulas*
1 *prakrama*	=	2 *padas*
1 *aratni*	=	2 *prādeśas* = 24 *aṅgulas*
1 *yāma*	=	1 *puruṣa* = 5 *aratnis* = 120 *aṅgulas*
1 *vyāyāma*	=	4 *aratnis*

The interrelation of *aṅgula* and centimetre or inch may be found in an earlier paper by the author,[57] where the units of linear measurement, weight and time are discussed in detail. The Āpastamba Kātyāyana and Mānava have also adopted[58] the units of the above table with a very minor difference. According to the Kātyāyana (5.9), 1 *pada* = 12 *aṅgulas*. Also Kātyāyana (5.9)

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and Mānava (4.4) use *vitasti* in place of *prādeśa*. It is worth mentioning here that the term *prādeśa* was again used in place of *vitasti* by *Ādi Śaṅkarācārya*,[59] the great philosopher. It is also remarkable that the term *prādeśa* was again replaced by *vitasti* which is prevalent in north India even today. According to the Mānava,[60] there are some more units such as:

6 *tuṇḍas* made from the upper cover of a lotus stalk = 1 hair (*bāla*) of a 3 year old calf

3 such *bālas*	=	$\frac{1}{2}$	of a mustard seed
2 mustard seeds	=	1	*yava*
6 *yavas*	=	1	*aṅgula*
10 *aṅgulas*	=	1	*prādeśa*
12 *aṅgulas*	=	1	*vitasti*
3 *vitastis*	=	1	*aratni*
4 *śayas* (*aratnis*)	=	1	*vyāyāma*

We notice here two remarkable facts:

(*i*) In this table of the Mānava, *prādeśa* and *vitasti* are not synonymous as in the other Śulbasūtras.

(*ii*) The term *śaya* used by the Mānava and its measurement are found in the later works.[61]

For details of the lay-out plan of sacrificial fires and the construction of various altars, the reader is referred to the work of Sen and Bag.[62]

It is needless to say that geometrical figures are even now commonly used in traditional Vedic ceremonies. One of the surprising achievements in the field of geometry is, thus, the *Śrīyantra* which is one of the objects (*yantras*) used for meditation in various schools of Hindu *tāntrikas*. Its description may be found in the *Nitya Ṣoḍaṣikarṇava*.[63] It is noteworthy that the Institute of Science and Natural Technology, Moscow, held a seminar on Indian Śrī-Yantra and its Mathematical Characteristic.[64]

VEDIC MATHEMATICS

As has been said in the beginning, the construction of altars for Vedic sacrifices required a counting process. This anticipates the fact that the antiquity of the counting process in India goes back to a period earlier to that when the *mantras* themselves were revealed, i.e. to the so-called pre-Vedic era. The *mantra*, '*Sahasram me dadatoaṣṭakarṇyāḥ*'[65] supports this fact as it indicates that the numerals and the writing of numerals were very well known in the period when the mantra was revealed.

The Ṛgveda[66] indicates that (some) numerals were written on the dices used for gambling purposes. Not only this, many religious rituals involved counting process. In the *sūtra* literature we find that the counting process was indispensable for even philosophical expositions. Indeed, one of the oldest philosophical system (the Sāṅkhya system) was named after Sāṅkhya (number).

It has been surmized from the Indus Valley seals that the letters were derived from numeral signs and, on the other hand, letters indicated numerals.[67]

It is worth mentioning here that Indian numerals were transmitted to the Arabs in a later period as recounted by Ginsburg:

> The Hindu notation was carried to Arabia about AD 770 by a Hindu scholar named Kaṅka who was invited from Ujjain to the famous court of Baghdad by the Abbaside Khalif Al-Mansur. Kaṅka taught Hindu Astronomy and Mathematics to the Arabian scholars and with his help, they translated into Arabic the Brahma Sphuṭa Siddhānta of Brahmagupta.

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> The recent discovery by the French savant M.F. Nau proves that the Hindu numerals were well known and much appreciated in Syria about the middle of the seventh century AD.[68]

The numerals were carried from Arabia towards the West through Egypt and northern Arabia. They entered Europe in the eleventh century. Europeans recognize them as Arabic notations because they received them from the Arabs, but remarkably, the Arabs themselves have unanimously called them Hindu figures (*Al-Arquan-Al-Hindu*)

One can imagine the tremendous difficulties of operations like multiplication and addition, etc., with the Roman and other such numerals. The clumsy method of using a counting frame and the use of such numerals had long retarded progress. The ten Hindu numerals, including the zero sign, liberated the human race from these computing restrictions and showered a flood of light on the behaviour of numbers. French mathematician, Laplace, remarks:

> It is India that gave us the ingenious method of expressing all numbers by means of ten symbols, each symbol receiving a value of position, as well as an absolute value; a profound and important idea which appears so simple to us now that we ignore its true merit, but its very simplicity, the great ease which it has lent to all computation, puts our arithmetic in the first rank of useful inventions; and we shall appreciate the grandeur of this achievement when we remember that it escaped the genius of Archimedes and Apollonius, two of the greatest men produced by antiquity.[69]

It is remarkable that the ancient Indians not only invented these numerals, but gave them perfection at the very beginning as is indicated by G. Sarton while mentioning the invention and development of spectacles in Italy: 'There is not a matter like Hindu numerals which were almost perfect from the moment of their creation.'[70]

Zero and the Counting Power

Not only numerals, but also zero, one of the most important tools in mathematics, was a gift by Indian savants as is clear from the account by Datta and Singh.[71] Halsted has written about the vital significance of this invention thus:

> The importance of the creation of the zero mark can never be exaggerated. This giving to airy nothing, not merely a local habitation and a name, a picture, a symbol but helpful power, is the characteristic of the Hindu race from whence it sprang. It is like coining the Nirvana into dynamos. No single mathematical creation has been more potent for the general on-go of intelligence and power.[72]

Zero was obviously used as a number in India in the remote past, otherwise, how could ancient Indians have worked out the system of decimal place value, on the basis of which, big numbers of the Taittirīya-Saṁhitā and the Vālmīkīya Rāmāyaṇa could be constructed? It is worth mentioning here that the Taittirīya-Saṁhitā[73] (before 2000 BC)[74] gives terminology for the numbers of order 10^{19} as:

(Eka)	1	*(Madhya)*	10^{10}
(Daśa)	10	*(Anta)*	10^{11}
(Śata)	10^2	*(Parārdha)*	10^{12}
(Sahasra)	10^3	*(Uṣas)*	10^{13}
(Ayuta)	10^4	*(Vyuṣita)*	10^{14}
(Niyuta)	10^5	*(Deśyata)*	10^{15}
(Prayuta)	10^6	*(Udyata)*	10^{16}
(Arbuda)	10^7	*(Udita)*	10^{17}

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(Nyarbuda)	10^8	*(Svarga)*	10^{18}
(Samudra)	10^9	*(Loka)*	10^{19}

As is indicated by the present author,[75] the terminology for the numbers in the range 10^9 – 10^{19} varied slightly in the medieval period.

The Vālmīkīya Rāmāyaṇa[76] goes even further and gives the terminology for number of the order 10^{60} as follows:

Śataṁ śatasahasrāṇāṁ koṭimāhurmanīṣiṇaḥ
Śatam Koṭisahasrāṇāṁ śaṅkurityabhidhīyate etc.

Thus,

$100 \cdot 1000 \cdot 100$		$= 10^7$	$=$	1 *Koṭi*
10^5	*Koṭi* $= 10^5 \times 10^7$	$= 10^{12}$	$=$	1 *Śaṅku*
10^5	*Śaṅku*	$= 10^{17}$	$=$	1 *Mahāśaṅku*
10^5	*Mahāśaṅku*	$= 10^{22}$	$=$	1 *Vṛnda*
10^5	*Vṛnda*	$= 10^{27}$	$=$	1 *Mahāvṛnda*
10^5	*Mahāvṛnda*	$= 10^{32}$	$=$	1 *Padma*
10^5	*Padma*	$= 10^{37}$	$=$	1 *Mahāpadma*
10^5	*Mahāpadma*	$= 10^{42}$	$=$	1 *Kharva*
10^5	*Kharva*	$= 10^{47}$	$=$	1 *Mahākharva*
10^5	*Mahākharva*	$= 10^{50}$	$=$	1 *Samudra*
10^5	*Samudra*	$= 10^{55}$	$=$	1 *Ogha*
10^5	*Ogha*	$= 10^{60}$	$=$	1 *Mahaugha*

It is to be remarked here that the '*Samudra*' which was used for 10^9 in the Taittirīya-Saṁhitā, has been used here for 10^{50} and all other terms for large numbers in this sequence are different from those found in the Taittirīya-Saṁhitā. It is noticeable that except for this context, the numerical terms found at other places of the Vālmīkīya Rāmāyaṇa, are from the Taittirīya-Saṁhitā with the same meaning, e.g., *Niyuta* and *Nyarbuda*,[77] *Abuda, Madhya, Antya, Samudra and Parārdha.*[78]

It seems that the above terminology of the Vālmīkīya Rāmāyaṇa for large numbers was not common, and was confined to experts who were highly specialized in the counting process since the numbers above *Koṭi*, as has been stated, were hardly used at any other place of the Vālmīkīya Rāmāyaṇa itself. This is why Śuka and Sāraṇa had first to define the terminology, and then gave the account of Rama's army.[79] It is noticeable here that Śārdula, the next main messenger of Rāvaṇa, reported on the impossibility of counting the army.[80] Probably, due to the over limited use of the terms of the above sequence of large numbers, some of the terms disappeared in later literature, and those which are found do not carry the same sense as mentioned above. The Samarāṅgaṇasūtradhārā[81] (eleventh century AD) uses *Vṛnda* for 10^9, *Kharva* for 10^{10}, *Śaṅku* for 10^{12} and *Padma* for 10^{13}. Some scholars like David Pingree hold the view that 'the presence of names of multiples of 10 in the Taittirīya-Saṁhitā does not mean that the authors of that text used zero. However, the use of powers of 10 in the place value notation is suggestive of the knowledge of zero.[82] These scholars also assert that 'the Rāmāyaṇa passages are late and also prove nothing about the use of zero in India'. It is customary with them to reject the passages which they do not like, by saying that 'these passages are later insertions'. Suppose this is a fact, then Vālmīki could have given the counting of Rama's army without using the numerical terminology in these passages. Had it been the actual situation, Vālmīki would not have concluded in the earlier counting as 'with their forces of incalculable number',[83] but could have given the actual counting of the army at that very instant. Also it is unlikely that a passage giving terminology in terms of multiples of 10^5, can prove nothing about the use of zero in India. It is difficult to suppose the systematic multiples of 10^5 without the use of zero for place value notation. Further, the assertion that

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'the earliest actually corroborated reference to zero in India is in the *Yavanajātaka* composed by Sphujidhvaja in AD 269/270' seems to be arbitrary.[84] One should notice in this context that even ignoring the passages of the Taittirīya-Saṁhitā and the Vālmīkīya Rāmāyaṇa, the use of zero is found in the Chandaḥsūtras of Piṅgala, (approx. 200 BC)[85] and the Bakṣālī manuscript.[86]

Also these scholars assume that 'the zero had been used in Babylonian mathematics and astronomy and in Greek astronomy long before this (i.e., AD 269/270)' for which they have no firm documentary proof.

In the Buddhist treatise Lalitavistara (first century BC) we find the terminology for *śatottaragaṇanā* (centesimal scale) as follows:[87]

100	*Koṭis*	=	1	*Ayuta*
100	*Ayutas*	=	1	*Niyuta*
100	*Niyutas*	=	1	*Kaṅkara*
100	*Kaṅkaras*	=	1	*Vivara*
100	*Vivaras*	=	1	*Kṣobhya*
100	*Kṣobhyas*	=	1	*Vivāha*
100	*Vivāhas*	=	1	*Utsaṅga*
100	*Utsaṅgas*	=	1	*Bahula*
100	*Bahulas*	=	1	*Nāgabala*
100	*Nāgabalas*	=	1	*Titilambha*
100	*Titilambhas*	=	1	*Vyavasthāna Prajñapti*
100	*Vyavasthāna Prajñaptis*	=	1	*Hetuhil*
100	*Hetuhils*	=	1	*Karahu*
100	*Karahus*	=	1	*Hetvindriya*
100	*Hetvindriyas*	=	1	*Samāptalambha*
100	*Samāptalambhas*	=	1	*Gaṇanāgati*
100	*Gaṇanāgatis*	=	1	*Niravadya*
100	*Niravadyas*	=	1	*Mudrābala*
100	*Mudrābalas*	=	1	*Sarvabala*
100	*Sarvabalas*	=	1	*Visaṁjñāgati*
100	*Visaṁjñāgatis*	=	1	*Sarvjñā*
100	*Sarvajñās*	=	1	*Vibhutaṅgamā*
100	*Vibhutaṅgamās*	=	1	*Tallakṣaṇa*

Thus, 1 *Tallakṣaṇa* = 10^{53}

The Pālī grammarian Kāccāyana has termed 10^{140} Asaṅkheyya.[88]

The views of Smith and Karpinski are worth mentioning here. They remark, 'The Hindus anticipated Archimedes by several centuries in the matter of evolving a series of number names which are sufficient to exceed not only the number of sand-heap as the whole earth, but one as large as the universe.'[89]

Some other historians of mathematics, e.g. Crossley,[90] who are ignorant of these achievements of the ancient Indians have wrongly attributed to some later scholar (Nicholas Chuquet, AD 1494) the terminology for large numbers (like 10^{12} and 10^{18}). This may be true for other cultures as is confirmed by Albiruni of the eleventh century who says: In counting who go beyond a thousand, are only Hindus.[91] Quadi-sa'id also attributes to Indians the credit for developing numerical sciences:

> In the domain of numerical sciences, we have their, i.e. of Indians, 'hisāb al-ghubār' which was explained by al-khwārizmī. It is a very compendious and quick system of calculation, easy to understand, simple to adopt, and remarkable in its composition, bearing testimony to the sharp intelligence, creative power and remarkable faculty of invention of the Indians.[92]

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Time of Introduction of the Place Value Notation

It is worth mentioning here that the ancient Indians introduced the decimal place value system after the early Vedic period. This we infer because the number 3339 has been mentioned by an additive method in the Ṛgveda[93] as 300 + 3000 + 30 + 9. Place value notation has not been used here. Even in the Mahābhārata, Strīparva[94] we find the same method used to express 1660020000 as 10 (10000) × (10000) + 20000 + 60 (10000000) + 6 (10000000) and 24165 as 24 (1000) + 100 + 60 + 5.[95]

But certainly the place value notation was used before the early centuries of the Christian era since, in Kamalaśīla's Commentary[96] on the Tattvasaṁgraha of Śāntarakṣita we find a quotation from Vasumitra (AD 100) which tells that the place value notation was employed in AD 100 for delineating philosophical principles. This is only possible if this notation was very well known in the public.

Fractions

In the Vedic literature we find fractions like *ardha* $(=\frac{1}{2})$, *pāda* $(=\frac{1}{4})$, *śafa* $(=\frac{1}{8})$, *kuṣṭha* $(=\frac{1}{12})$ and *tri-pāda*[97] $(=\frac{3}{4})$, *kalā*[98] $(=\frac{1}{16})$. The Śulbasūtras term a fraction as *bhāga*; e.g. *pañca-daśa bhāga*[99] $=\frac{1}{15}$. In the Śulbasūtras we also find fractions other than the unit fractions; e.g. *caturtha-saviśeṣa saptama*,[100] $\left\{\frac{1}{7}\left(\frac{1}{4}\sqrt{2}\right)\right\}$, *caturdaśa prakramān triṁśca prakrama saptabhāgān*[101] $(14\frac{3}{7}$ *prakramas*), and *kalā daśa saviṁśā nāḍikā*[102] $(= 10\frac{1}{20})$. Operations with elementary fractions are also found in the Śulbasūtras.

Classification of Numbers

It seems that Vedic seers had the concept of classifying numbers in *yugma* (even) and *ayugma* (odd) classes as is clear from the Taittirīya Saṁhitā.[103] It can also be seen in the Vājasaneyī Saṁhitā.[104] The Anuyogadvāra Sūtra[105] (*c.* 100 BC) classifies numbers as *saṁkheya* (numeral), *asaṁkheya* (innumeral) and *ananta* (infinite).

Fundamental Operations

It has been mentioned above that invention of the ancient Indian numerals along with the place value notation opened the vistas of mathematical computations. These computations or fundamental operations are:

(a) *saṁkalita* (addition)
(b) *vyavakalita* or *vyatikalita* (subtraction)
(c) *guṇana* (multiplication)
(d) *bhāga* (division)
(e) *varga* (square)
(f) *ghana* (cube)
(g) *vargamūla* (square-root)
(h) *ghana-mūla* (cube-root)

Methods for these operations are very well known. As Datta and Singh write: 'These methods have been well known and taught to children, practically without any change, for the last fifteen hundred years of more.'[106] Those who obtain their primary training in the villages, still perform these operation on *pāṭī*. So the old name of arithmetic is *pāṭīgaṇita*. A brief description of these operations is given as follows:

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(a & b) *Addition and Subtraction*: We do not find much description of addition and subtraction in ancient Indian mathematical works due to the simple and self-evident character of these operations. However, later mathematicians gave their precise definitions. Āryabhaṭṭa II defines addition as follows: 'The making into one of several numbers is addition.[107] The taking out [of some number] from the *sarvadhana* [total] is subtraction[108] what remains is called *śeṣa* [remainder]'. For a detailed study on these operations, the reader is referred to Datta and Singh.[109]

(c) *Multiplication*: According to the Bakṣālī manuscript (third verse), multiplication was viewed as *parasparakṛtaṁ* (making together). For the synonyms and a detailed study of the following seven methods of multiplication and for their transmission to western countries, the reader is again referred to Datta and Singh:[110]

(*i*) Door Junction method (*kapāṭa sandhi*)
(*ii*) Gelosia method
(*iii*) Cross multiplication method (*tastha*)
(*iv*) Multiplication by separation of places (*Sthāna Khaṇḍa*)
(*v*) Zigzag method (*gomūtrikā*)
(*vi*) Parts multiplication method
(*vii*) Algebraic method (*iṣṭa guṇana*)

(d) *Division:* Division, which was considered to be the inverse of multiplication, does not find a significant place in the known treatises of ancient India but since Āryabhaṭṭa I has clearly utilized this operation in *Gulikāntareṇa vibhajed dvayoḥ puruṣayostu rūpakaviśeṣam*[111] and in the process of extracting square and cube-roots,[112] we can safely conclude that the operation was very well known to the mathematicians of the pre-Āryabhaṭṭa era. Interested readers may consult Datta and Singh.[113]

(e) *Square:* The equivalent term for square in ancient Indian literature is *varga. Kṛti* is also used, but very rarely. The statement of Āryabhaṭṭa I, *Vargaḥ Sadṛśadvayasya saṁvargaḥ,*[114] i.e., 'the product of two equal quantities is also *varga*', suggests that the operation was performed by the mathematicians of the earlier period. The term *varga* is seen even in the Śulba-sūtras.[115]

For a detailed study on this operation the reader is referred to Datta and Singh.[116]

(f) *Cube:* In ancient Indian terminology, cube is *ghana.* This operation was also known to early Indian mathematicians since it is found in the Āryabhaṭīya as

Sadṛśatrayasaṁvargo ghanastathā dvādaśāśriḥ syāt[117]

i.e., 'the continued product of three equals and also the solid... are called *ghana*'. The reader is again advised to consult Datta and Singh[118] for a detailed study of this operation.

(g) *Square Root:* Square root was termed as *vargamūla* by the ancient Hindus. It is the cause or origin of the square. The term *vargamūla*, in the view of Datta and Singh,[119] occurs in the Anuyogadvārā-sūtra, a Jaina work of *c.* 100 BC and was borrowed by the Arabs and translated as *Jadhra.* A Latin translation is radix. For further details, they refer to the papers by Datta.[120] The method of this operation is given by Āryabhaṭṭa I as:

Bhāgān haredavargānnityaṁ dviguṇena vargamūlena.
Vargādvarge śuddhe labdhaṁ sthānāntare mūlaṁ.[121]

Which means, 'divide always the non-square (*avarga*) places by twice the square-root (upto the preceding odd places); after having subtracted the square (of the quotient) from the square place (*varga*), (then) the quotient placed at the separate place gives the root'.

For illustration of this rule by examples and for other details, the reader may again consult Datta and Singh.[122]

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(h) *Cube Root*: In Hindu terminology, cube root was *ghanamūla*. A method for cube-root extraction is given by Āryabhaṭṭa as:

aghanādbhajeddvitīyāt triguṇena ghanasya mūlavargeṇa
vargastripūrvaguṇitaḥ śodhyaḥ prathamād ghanaśca ghanāt.[123]

The meaning of this passage and a detailed description of the operation may be seen in Datta and Singh.[124] Since the description of the method of the operation as given by Āryabhaṭṭa I is too concise, we may conclude, without any reservation, that it was well-known to earlier mathematicians.

Indices and Logarithms

Jaina mathematicians of *c.* 300 BC used powers of integers, known today as indices. Examples like:

$$x^a \times x^b = x^{a+b} \quad (x^a)^b = x^{ab}$$

are found in their literature.[125]

Dhavalā commentary of Vīrasenācārya tells that the Jaina mathematicians of the earliest centuries of the Christian era had the concept of logarithms to the base 2,3,4 although, no application of the concept is found in that era. Dhavalā informs us that the following rules were known:[126]

(*a*) $\log \frac{m}{n} = \log m - \log n$
(*b*) $\log (m \times n) = \log m + \log n$
(*c*) $\log_2 (2)^m = m$
(*d*) $\log (x^x)^2 = 2 \times \log x$
(*e*) $\log \log (x^x)^2 = \log x + 1 + \log x$
$\log \log x$ was known as the *vargaśalākā* of x
(*f*) $\log (x^x)^{x^x} = x^x \log x^x$ etc.

Progressions and Their Sum

Evidence of interest in series or progressions is found since the early Vedic era. Various series are mentioned in Taittirīya Saṁhitā.[127] Śatapatha Brāhmaṇā,[128] and the Bauddha work Dīgh nikāya.[129] Also we find the general rule for the summation of an arithmetic progression as:

$$a + (a+b) + (a+ab) + \ldots + a + (n-1)b = na + (n-1)\frac{b}{2}$$

where a is the first term, b the common difference and n is the number of terms. Āryabhaṭṭa I gave this sum[130] as $\frac{n}{2}(a+l)$, where l is the last term. Further, Āryabhaṭṭa[131] gave the following summation rules:

$$1^2 + 2^2 + 3^3 + \ldots + n^2 = \frac{n(n+1)(2n+1)}{6}$$

$$1^3 + 2^3 + 3^3 + \ldots n^3 = \left(\frac{n(n+1)}{2}\right)^2$$

Word Numerals and Alphabet Numeration

The ancient Indian mathematicians and astronomers used to contribute their works in verse, which facilitated committing the principles to memory. So they needed some simple

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method of expressing large numbers which were required very often for their astronomical works. To fulfill this need they invented word numerals which were so fascinating that later mathematicians and astronomers adopted them at once. Consequently, in the later works like the Sūrya Siddhānta, the Āryabhaṭīya, the Pañca-Siddhāntikā and the Brahma Suphuṭa Siddhānta, etc. they were used very extensively. This marvellous technique is employed even today whenever very big numbers are needed to be expressed in verses.

Apart from the ease it lends in memorizing principles, it has one more charming advantage: that a particular number can be expressed in various ways while forming the word chronograms. Thus, word numerals prove to be a boon for metrical compositions. In this method, the number 0 is expressed as *kha, amber, gagana, ākāśa, vyoma, nabha,* etc. A list of word numerals is given by Datta and Singh[132] for numbers up to forty-nine. The Pauliśa Siddhānta[133] (*c.* 400) used this method to express the number 15,82,273,800 as *kha* (0), *kha* (0), *aṣṭa* (8), *muni* (7), *Rāma* (3), *aśvi* (2), *netra* (2), *aṣṭa* (8), *sāra* (5), *rātripaḥ* (1). While reading a number written by this method, one has to follow the rule, *Aṅkānām Vāmato gatiḥ,* i.e., the digit read first will be placed at the right end, the next digit will be to the left of the first (i.e. at tens place), the next digit at the hundreds place, and so on.

Some savants, who were very particular about brevity and conciseness, used the letters of alphabets to express numbers. This can be found even in the works of the great grammarian, Pāṇini (*c.* 700 BC). Thus, according to the Kaiyyaṭa's commentary, the letter *i* written above the Pāṇini Sūtra V.1.30 indicates that it applies only to the next two sūtras. This shows that according to Pāṇini $a = 1$, $i = 2$, $u = 3$ etc.[134] Later on, alphabet numeration was developed well by Āryabhaṭa I.

Algebraic Equations

As has been mentioned above, the construction of altars for *yajñas* involved the problems in various branches of mathematics. So algebraic equations date back to the Śulba period (before 500 BC). The transformation of square altars into rectangular[135] forms involved the equation $ax = c^2$. It is evident from the Taittirīya Saṁhitā and the Śatapatha Brāhmaṇā that the ancient Hindus had to consider the equation $x^2 + y^2 + z^2$, in various other constructions.

Examples of integral solutions of these equations are found in the Śulba-sūtras[136] as $3^2 + 4^2 = 5^2$, $12^2 + 5^2 + = 13^2$ etc.

This was merely geometry-oriented algebra, but it is also well known that algebra in general, like the decimal-place value notation, was initiated by the ancient Indians as is remarked by Dantzing: 'Is it not equally strange that algebra, that cornerstone of modern mathematics, also originated in India and at about the same time that positional numeration did?[137] The process of dealing with and investigating unknown quantities may be found in the Sthānāṅga-sūtras[138] (350 BC) in which we find the term *jāvantāvati* (= *yāvattāvat*) in sūtra 747. As mentioned above, the Sthānāṅga-sūtra finds mention of the following: simple equations (*yāvattāvat*), quadratic equations (*varga*), cubic equations (*ghana*), biquadratic equations (*vargāvarga*), and permutations and combinations (*vikalpa*). Further, the Bakṣālī Manuscript contains *yādṛcch, iṣṭakarma* (rule of false position). *Iṣṭakarma* is a process of arithmetic in which the answer is supposed to be 1 or 100. Some problems on *iṣṭakarma* in the manuscript cannot be solved without the application of simple equations.[139] In fact, *iṣṭakarma* is rightly considered by some mathematicians to be the root of *bījagaṇita.*

In the period of Āryabhaṭṭa I, the term *gulikā* was employed for an unknown quantity and thus the following verse of Āryabhaṭṭa I is considered to the explicit foundation of *Bījagaṇita*:

Gulikāntareṇa vibhajeddvayoḥ puruṣayostu rūpakaviśeṣam
labdhaṁ gulikāmūlyam yadyarthakṛtam bhavati tulyam.[140]

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According to Bhāskara I (AD 629), the word *gulikā* is used for a thing of unknown value. The term *yāvattāvat* is also used for such a thing: *rūpaka* is used for a coin. The verse has thus the meaning: If two persons have equal wealth, then in order to get the value of one *gulikā*, divide the difference between the *rūpakas* (known amounts) with the two persons by the difference between their *gulikās*. The quotient will then be the desired value. In explicit words, the verse says: Two persons have equal wealth. One of them has *m gulikās* and *r rūpakas* and the other *n gulikās* and *p rūpakas*. The verse tells us the process of finding the cost of one *gulikā* in terms of coins (*rūpakas*). Thus, algebraically: if $mx + r = nx + p$, where x is the cost of one *gulikā*,

then $x = \frac{p-r}{m-n}$ coins (*rūpakas*)

The following facts are worth mentioning: In Sanskrit literature, *Bījagaṇita* had mainly two synonyms: (i) *Kuṭṭakagaṇita* and (ii) *Avyaktagaṇita*.

In the Brahma-Sphuṭa-Siddhānta of Brahmagupta, there is a separate chapter on *Bījagaṇita* called *Kuṭṭakādhyāya*. It is evident that by the time of Brahmagupta (AD 598-665) the rules for algebraic operations had taken the form of axioms.

Caliph Al-Mā'mūn, a ruler of Baghdad during the AD 813-833 established a house of wisdom, named *Bayt-al-Hikmā*. In this period, Muhammed ibn al-Khwārizmī went to Afghanistan on an administrative assignment and, while returning home he visited India. After return, he wrote a book in AD 830 entitled *Hisab al-jabra w'al-muqābalā* and dedicated it to the Caliph. The book is either a translation of works of Brahmagupta or Bhaṭṭa Balabhadra, or else, it is based on them, as is indicated by *Encyclopaedia Britannica*:

> The circumstances of this treatise professing to be only a compilation and moreover, the first Arabian work of the kind has led to an opinion that it was collected from books in some other language .... The Hindus, as we shall presently see, had a science of algebra and we may conclude with some probability that the Arabian Algebra was originally derived from India.[141]

An Italian merchant carried it to Italy. He is reported to have written the *Scritti di Leonardo Pisano* (2 volumes; ed. B. Bonocompagni, Rome, 1857, 1862). It was through him that the *al-jabra w'al-muqābalā* reached Europe. It was translated twice into Latin in the twelfth century by Gerard of Cremona and Robert of Chester (AD 1140) as *Liber algebrae almuqabala* and gained there such a popularity that the subject itself was named *algebra*, which is an abbreviated form of *al-jabra w'al-muqābalā*.

While pointing out that the Arabs came to know negative quantities at a much later stage, Crossley writes:

> It is curious that this aspect of Hindu algebra did not pass to the Arabs .... Nevertheless, it is generally accepted that algebra including the radical solution of quadratic equations, was transmitted from the Hindu to the Arabs before the ninth century had passed.[142]

VEDIC ASTRONOMY

Introduction

The time of *yajñas* was as important as the shape and size of the altars. So astronomy in ancient India is as old as the Vedas since the Vedas initiate *yajñas* (fire sacrifices) and enjoin that they adhere strictly to the rules about the times of performance, which were determined by astronomy. As the Vedāṅga Jyotiṣa says:

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Vedā hi yajñārthamabhipravṛttāḥ
Kālānupūrvyā vihitāśca yajñāḥ
Tasmādidaṁ Kālavidhānaśāstram
Yo jyotiṣam veda sa veda yajñaṁ.[143]

Calculation of dates of eclipses was a matter of national importance and it was the responsibility of the astronomer to foretell the time and duration of their occurrence. Also, other information relevant for the religious life of the people, like the time of full moon, its last disappearance and the first appearance, etc. was required for the performance of particular rituals like *Darśapūrṇamāsa,* and *Caturmāsa,* etc. It should be noted here that, among the various families of the seven principal seers of the Ṛgvedic hymns, the Atris, who are the seers of the fifth *Maṇḍala,* are distinguished for their particular interest in astronomy. The Saṁhitās, as also the Brāhmaṇas, frequently mention their name in connection with eclipse-hymns. The Sāmaveda and its Brāhmaṇas and the sūtras which give a complete treatment of the *gavāmayana* and the *sattras* of various duration, have a lot to do with concepts of calendrical astronomy.[144] In the Ṛgveda we have the mantra;[145]

Veda māso dhṛtavrato dvādaśa prajāvataḥ
Veda ya upajāyate

which, rendered in to English, reads: 'Who by way of observing *vrata,* know twelve months that give fruits (consequences) and also know the enhanced thirteenth month'. From this, one can see that the ancient Hindus used to compensate the year with respect to seasons by way of adding one month to the year after every few years. Not only this, we find mention of stars in a mantra[146] of the Ṛgveda which indicates that the ancient Indians considered the motion of stars and the moon. The Atharva Saṁhitā contains a complete list of the 27 nakṣatras.[147]

Yajurveda[148] mentions a *nakṣatradarśa* (astronomer). *Nakṣatra vidyā* (astronomy) has been mentioned in the Chāndogyopaniṣad at several places.[149] The Maitrāyanī Saṁhitā[150] and the Kāṭhaka Saṁhitā[151] mention 28 nakṣatras. Not only this, the Taittirīya Saṁhitā[152] and the above cited Maitrāyanī Saṁhitā give lists of the presiding deities of 28 nakṣatras. However, there are slight differences in the nomenclature as one can notice from the above hymn from the Taittirīya Saṁhitā where *Āśleṣa* is read as *Āśreṣa.* Some other differences are mentioned below:

Mṛgaśīrṣa	=	*Invākā = Invāgā*
Ārdrā	=	*Bāhu,*
Tiṣya	=	*Puṣya*
Vicitrāsu	=	*Mūla,*
Śroṇa	=	*Aśvattha = Śravaṇa*
Śraviṣṭhā	=	*Dhaniṣṭhā*
Proṣṭhapadā	=	*Pūrvābhādrapadā and Uttarābhādrapadā*
apabharaṇis	=	*Bharaṇis*

The nomenclature of the lunar months was on the basis of the constellations in which full moon occurred. Thus, Caitra from *citrā,* Vaiśākha from *viśākhā,* Jyeṣṭha from *jyeṣṭhā,* ... Phālguna from *phālgunī.* But the Taittirīya Saṁhitā[153] mentions the seasonal or solar months too, as Madhu and Mādhava of the Spring, Śukra and Śuci of the Summer, Nabha and Nabhasya of the rainy season, Saha and Sahasya of the dewy season, Tapa and Tapasya of the winter and Iṣa and Ūrja of the Autumn. These are also mentioned in the Śukla Yajurveda.[154]

The effect of planetary motions and meteorology evoked interest in ancient India. Vedic literature tells something of achievements of the ancient Indians in this behalf. Take, for example, studies in Jupiter. One can trace this account in the Ṛgveda:[155] *Bṛhaspatiḥ prathamam jāyamānaḥ.*

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Some few years back, ordinary people, and even modern scientists, held that Jupiter does not affect the earth (or inhabitants of the earth) since it is at a very long distance away. But modern scientific instruments noted recently[156] that it affects living creatures as well as non-living substances on the earth. According to the ancient sages, Jupiter is responsible for the progress of living beings on the earth.[157] It affects not only *en masse* but also individually. According to the Śāstras it is responsible for the good attributes of a man. For these reasons, the sages called it Jīva[158] and Guru[159] (or Devaguru). Its name, Guru is well known to everybody in India.

Weber suggests that the Indians must have discovered stars since the nomenclature of stars is particularly Indian.[160]

About the astronomical achievements of ancient Indian savants, *Encyclopaedia Britannica*[161] remarks: 'The science for which the brahmins, however, were most remarkable, is that of astronomy and in this, their progress was so great as even yet to furnish matter of admiration to the moderns.'

It should not be forgotten here that Indian meteorology claimed to forecast the weather six months in advance.

The fact that astronomical calculations had a vital role to play in any important public or personal activity, may be evidenced at a number of places in the Vālmīkīya Rāmāyaṇa and the Mahābhārata. A few instances are quoted here from these scriptures:

1. In the Bālakāṇḍa[162] it is said: 'Today the Maghā star is in ascendance and in three days, O mighty king, under the Uttara Phālgunī star, thou should perform the nuptial ceremony.' This depicts clearly that the sequence of stars was well known.
2. The Puṣya star was considered with a high distinction and is mentioned in the Ayodhyā Kāṇḍa (2.12, 4.2, 4.21) and the Yuddha Kāṇḍa (126.54)
3. In the Ayodhyā Kāṇḍa (41.11) all the planets are said to have come together when Rāma, Sītā and Lakṣmaṇa were departing from Ayodhyā for exile. This was an omen portending the battle of Laṅkā)
4. The Ayodhyā Kāṇḍa (80.17) tells that auspicious planets and hours were considered even in establishing the camp of Bharata.
5. The Ayodhyā Kāṇḍa (89.17) mentions *Maitra Muhūrta* which is not very prevalent today.
6. Jaṭāyu tells in the Ayodhyā Kāṇḍa (68.12) that 'The hour in which Rāvaṇa bore away Sītā is called *Vinda* and the looser soon recovers that which is lost in this hour.'
7. Rohiṇī is mentioned in the Sundara Kāṇḍa (17.24, 19.9) and the Yuddha Kāṇḍa (92.45, 102.32)
8. Planets Mars and Mercury find their mention in the Yuddha Kāṇḍa (54.28)
9. The *Pañcamī tithi* (fifth day of the lunar fortnight) has been mentioned in the Yuddha Kāṇḍa (124.1, 125.26)
10. Saumya (the planet Mercury) has been mentioned in the Uttara Kāṇḍa (100.20)

Also in the Mahābhārata we can find many instances of astronomical knowledge. A few are mentioned below:

It is well known that, on being defeated in gambling, the Pāṇḍavas were required to live in exile for 12 years and then to live incognito (i.e., in *ajñātavāsa*) in the thirteenth year. When Duryodhana attacked Virāṭa, who had given the Pāṇḍavas shelter, Arjuna was constrained to fight against the Kauravas. When some members of the Kaurava army recognized Arjuna, there was a debate on whether thirteen years had passed since the beginning of the exile or not. Bhīṣma then gave the decision as follows:[163]

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Teṣāṁ kālātirekeṇa jyotiṣāṁ ca vyatikramāt
Pañcame pañcame varṣe dvau masāvupajāyataḥ
Eṣāmabhyadhikā māsāḥ pañce ca dvādaśakṣapāḥ
Trayodaśānāṁvarṣāṇāmiti me vartate matiḥ

which, when rendered into English, reads, Due to lapse of time and shifting of planets there are two extra months (*adhimāsas*) in a span of five years. As for as I understand, these (Pāṇḍavas) have passed thirteen years five months and 12 days in exile. This shows clearly that the calculation of time was done according to *Vedāṅga Jyotiṣa* in that period.

A striking fact is mentioned in the Bhīṣma Parva:[164] just before the battle, two eclipses took place at a gap of only 13 days. First, the lunar eclipse took place at the full moon (*pūrṇimā*) of Kārttika; and the second, a solar eclipse, took place after 13 days only. It is remarked in the text itself that this is very rare and is a menacing augury.

Forward and backward motion of stars has also been mentioned in the Karṇa Parva:

Pratyāgatya punarjiṣṇurjaghne samsaptakān bahūn
Vakrātivakragamanādahgāraka eva grahaḥ [165]

The position of the planets among the stars has been mentioned at several places in the Mahābhārata. For instance, one can see in the Bhīṣma Parva (chapter 3: verses 12-15, 17-18, 27) where Vyāsa warns Dhṛtarāṣṭra: 'O King, the war will begin after the month Kārttika because Śvetagraha (Ketu) will be on Svātī after passing Citra. The giant comet will reach Puṣya, Mars and Jupiter will be arrogant (*vakra*) on Maghā and Śravaṇa, respectively. Saturn will catch Pūrvā Phālgunī and torture it. Rising on Pūrvā Bhādrapada, Venus will shine. The sun and the moon will cause distress upon Rohiṇī and the terrible planet Rāhu has been taken up its position between Citra and Svātī. The red-bodied planet, effulgent like fire, passing round and round, stops encircling Śravaṇa overridden by Bṛhaspati. Extremely bright Jupiter and Saturn will be near Viśākhā for the whole of the year.' (These positions of the planets are believed to be violently destructive.)

From this, it is quite obvious that the people of the Mahābhārata period were experts in locating the motions of the planets, as also in determining the effect of such motions, which forms the subject matter of astrology, a branch of science derived from astronomy, which will be discussed below.

In fact, the independent discovery of the planets may be attributed to the ancient Indians as is remarked by A. Weber: 'Whether the Hindus observed the planets independently, or, whether the knowledge came to them from without, cannot as yet be determined; but the systematic peculiarity of the nomenclature points in the meantime to the former view.'[166]

Available Tradition of Astronomical Works

Rules of astronomy are scattered here and there in the Vedas. Considering the vital importance of astronomical calculations in daily life, ṛṣis composed the Vedāṅga Jyotiṣa long ago. Three treatises are found with this name: Ṛgveda Jyotiṣa, Yājuṣa Jyotiṣa and Atharvaveda Jyotiṣa. The first two, which are ascribed to Lagadhācārya, are well known. The Yājuṣa is a sort of enlarged and corrected version of the Ṛgveda Jyotiṣa. There are very minor differences between these two. It is traditionally known that Śuci, a disciple of Lagadha, composed and preserved the astronomical and astrological knowledge codified by his revered teacher before 1200 BC. Thus, the Vedāṅga Jyotiṣa is a gist of rules of astronomy, or, more or less, a collection of formulae on the subject. It should be noted here that the rules themselves must have been known earlier. A printed version of the Vedāṅga Jyotiṣa was first published about a hundred years ago by Sudhākara Dvivedī. Very recently (1984), the Indian National Science Academy, New Delhi, has republished it.

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The topics dealt in the Vedāṅga Jyotiṣa are as follows: The Yuga and its commencement, the northern and the southern equinoctial movements of the sun, and the consequent variation in the durations of the day and night; the *tithi* on the commencement of Ayana and Nakṣatra coinciding with the *tithi*; the duration of seasons (*ṛtu*); the order of the months and the lunar day at the commencement of the season; the method of calculating the intercalary month (*adhimāsa*) and the end of the *parvans*, the exact day and time of the commencement of the new *parvan;* inclusion of the three quarters of a *pratipadā* in *parvan;* the *aṣṭakas*, the method of knowing the coincidence of the relevant constellation with the moon, indicating the end of a *parvan*; the code words for the names of the *nakṣatras;* the *aṁśas* of the *sāvana* day also of constellations; the method of computing the *aṁśas*, *kalās* and *kāṣṭhās* of the constellation of the moon from any *tithi*; finding the *unnatāṁśas* of the sun at the end of a *parvan;* equinoctial day; the measurement of *ghaṭikās*; the method of finding the relevant position of the constellation with reference to the sun; the constellation of the sun at the end of a *parvan;* calculations for determining the constellational position of the sun and the moon by equal division of the zodiac circle; the number of *sāvana* days, months and seasons in a year and *yuga*; the movements of the constellations, rising of a new moon in a *yuga;* the number of revolutions of the constellations with reference to the sun in a *yuga* and the number of the *ayanas* of the moon, the number of *aṁśas* of a *sāvana* day and the number of the quarters of a constellation in a *yuga*; the *sāvana* days, the *sāvana* months, and the lunar as also the constellational months; the deities associated with the constellations; the nomenclature of the sacrificial host on the basis of these deities; *ugra* and *krūra nakṣatras*, justification of the intercalary month; measurements of time; the duration of time taken by the sun and the moon to pass through a constellation; the method of determining the duration of a day (*dinamāna*) of a particular *tithi*; the process of finding the remainder of a season (*ṛtuśeṣa*) in a particular *parvan;* and the method of checking the calculations by observations.

After the Vedāṅga Jyotiṣa, we find a treatise entitled Sūrya Prajñapti by Jaina astronomers, *c.* 500 BC. Its rules on astronomy contributed some remarkable facts. For example, one may mention motions of declination, celestial latitude, the obliquity of the ecliptic, a method of measuring celestial distances projected over the surface of the earth, systems of units of time; length and arc division; the use of shadow lengths for the determination of the time of the day at any instant etc. For a detailed study of these developments, one may consult a work of S.S. Lishk and S.D. Sharma[167] and also another of S.S. Lishk.[168]

These developments were made quite independently of any foreign influence and they actually paved the way for the development of Siddhāntic Astronomy. Due to ignorance or overlooking of these developments, some scholars (e.g. Pingree[169]) wrongly assert that Indian astronomy owes its origin to Greece and Mesopotamia. Certainly, this delusion will be removed if they look into the developments of the Jaina school of astronomy. Actually, they follow the following argument: since the earliest Indian scriptures (the Vedas, Brāhmaṇas, including the early Upaniṣads) do not mention five planets by name and also since the Vedāṅga Jyotiṣa mentions the sun, moon and the constellations (Nakṣatras) only, but does not mention the remaining five planets, it follows that the ancient Indians of the Vedic age were not aware of the planets and that they borrowed planetary knowledge from a foreign civilization, possibly from the Babylonians and Greeks, after the period of Alexander (300 BC). In this connection, it should be noted here that the earliest works of almost all the civilizations were not astronomical or mathematical and the same is true of the Vedas whose motive was the initiation of *yajñas* and therefore referred to the planets symbolically and indirectly; and mostly as a class among the other celestial bodies. The same view has been expressed by David Frawley: 'It is totally illogical to believe that a culture could notice so precisely these dim fixed starts along with the moon's position within them and not notice the planets which are much

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brighter than any of the Naksatras ... Hence the very existence of the Nakṣatra system suggests that the planets were known to the Vedic people'.[170] Further, he supports the view of A. Weber: 'The Hindu names of the planets and the mythology is uniquely Hindu which is another reason why one cannot easily attribute knowledge of them to a foreign influence.'[171] Frawley has also mentioned a unique feature of Vedic astronomy: 'In addition, it [astronomy in the Vedic period] must have noted the movements of the planets, particularly the Moon's conjunction with them. Such combinations (lunar Yogas) are well explained in classical Vedic astrology *which has no real counterpart among the Greeks.*'[172] While concluding his article he seems to have established that the five planets were very well known to the Vedic people: 'The Vedic seer families of the Aṅgirasas and Bhṛgus associated themselves with the planets Jupiter and Venus as these were the two brightest planets. There may have been longer Vedic calendars based upon these planets, like the 60 year cycle of Jupiter.'[173] Finally, he seeks the roots of the wrong assertion of the scholars: 'Hence there are strong astronomical considerations throughout the Vedas suggesting an early and independent tradition of astronomical observation, including the planets. The matter requires further exploration, which necessitates giving up the idea that there is no real astronomy or mathematics in the Vedas, *which now appears as no more than a prejudice of Eurocentric thinking*'.

It should not be forgotten here that there was an astronomer named Garga who wrote the *Garga Saṁhitā* which has been lost in antiquity. Varāhamihira quotes him at several places in the Bṛhat saṁhitā.[174] He is supposed to have lived before the Christian era. Also we find the Sūrya Siddhānta, which is considered to be an *Arsa* treatise, given by a representative of the Sun himself to Mayasura. Moreover, we see the gist of a Sūrya Siddhānta in the Pañca-Siddhāntikā. But both are different and the latter gives better results (*phala*).

In the fifth century AD, Āryabhaṭa (*b.* AD 476) wrote two books, Āryabhaṭīya and Arddharātrikapakṣa. Then followed Varāhamihira, (*d.* AD 587), who wrote two famous books, namely Pañca Siddhāntikā on astronomy and Bṛhatsaṁhitā on astrology. Pañca Siddhāntikā summarizes five astronomical theories known earlier. These are Pauliśa, Romaka, Vāsiṣṭha, Saura and Paitāmaha.

Applications of Astronomy

Astrology: As has been said above the Hindus developed a branch of science derived from astronomy in which they investigated the effect of motions of the planets. Its mode of working is three-fold (1) Predictive Astrology, (2) Mundane Astrology, and (3) Electional Astrology.

(1) *Predictive Astrology:* It aims at forecasting or indicating events to come in the future. Further, its mode of working is two-fold:

(a) *Natal horoscopy:* Results are predicted here on the basis of the birth chart. Its antiquity may be traced back in the Vālmīkīya Rāmāyaṇa:[175]

(i) The birth chart of lord Rāma is described quite transparently in the verse:

Nakṣatrai'ditidaivatye svoccasamstheṣu pañcasu
Graheṣu karkaṭe lagne vākpatāvindunā saha.

which mentions not only the planetary positions but also the fact of their exaltations.

(ii) Daśaratha says in the Ayodhyā Kāṇḍa 4.18-19 that 'the star of my birth is held captive by formidable planets like the Sun, Mars, and Rāhu; astrologers speak of this as an evil augury that indicates either the death of a king or the visitation of some grave distress'. This indicates that there were experts in planetary astrology in those times.

(b) *Horary Astrology:* There are occasions when the time of birth is not recorded properly but the consequence of some phenomenon or activity is required to be known quickly. Then

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the chart is erected for the time of posing the associated question to the astrologer and the consequences are foretold. However, if the birth chart is available to study the entire life of the person concerned, then the horary chart will only assess the particular situation with which the question poser is concerned at the time of the inquiry. Normally, it handles important problems faced by an average man in daily life. References may be found in the Vālmīkīya Rāmāyaṇa, (Uttara Kāṇḍa, 9.22-24).

(2) *Mundane Astrology:* It deals with the horoscopes of nations and provides predictions concerning the collective destiny of a class of people. References may be seen in the above-cited Mahābhārata, Bhīṣma Parva (chapter 3, verses 12-15, 17-18, 27).

(3) *Electional Astrology:* It is a sort of reverse of predictive astrology. A suitable moment is chosen here to ensure the success of any venture started at that moment.

Thus the scholars, (see G.R. Kaye[176]) who hold the view that there was no planetary astrology in India of the remote ages and the same was imported from the West, are certainly ignorant of these references to it in the Vālmīkīya Rāmāyaṇa and the Mahābhārata.

Astrology based on constellations may be traced abundantly in the Vedic literature. The Taittirīya Brāhmaṇā instructs as follows:

(i) The constellation Kṛttikā is presided over by Agni. One who performs the *agnyādhāna* rite (rite of depositing three fires) under the constellation Kṛttikā, acquires *brahmavarcas* but his belongings are liable to catch fire

(ii) The constellation Pūrvā Phālgunī is associated with Jāyā (wife) and a ṛṣabha (male); and is presided over by Aryaman[177] which means a liberal one, i.e. fond of giving.

This simply indicates that if the marriage ceremony is performed in Pūrvā Phālgunī then there will be liberal progeny. In fact, both the Phālgunīs are auspicious for the marriage ceremony since the Uttara Phālgunī is associated with *vahatavaḥ* (dowry) and *vahamānāḥ* (those who carry the dowry from the house of the bride). This fact is also corroborated by a Ṛgvedic hymn in connection with Sūryā vivāha:

Sūryāyāvahatuḥ prāgātsavitā yamavāsṛjat
Aghāsu hanyante gāvoarjunyoḥ paryuhyate[178]

Here *Arjunyoḥ* means both the Phālgunīs, *Aghā* means *Meghā* and *gāvohanyante* indicates that the cows (which are offered as dowry) are whipped. Further, Uttara Phālgunīs presided over by Bhaga and so this constellation bestows fortune upon the person who deposits three fires under this.

(iii) It is instructed in the Taittirīya Brāhmaṇā[179] that one who offers *caru* to Prajāpati under the Mūla constellation begets a prominent progeny. This is also supported by another hymn:[180]

Mūlaṁ prajāṁ vīravatī videya parācye tu nirṛti parācā.
Gobhirnakṣatraṁ paśubhiḥ saṁakṭaṁ aharbhūyāt yajamānāya mahyaṁ.

which means, May I beget a prominent and heroic progeny. Let Nirṛti, now facing us, go away

(iv) Not only this, there are hymns in the Taittirīya Brāhmaṇā which indicate the śānti ritual when a son is born in the Mūla constellation.[181]

Aharno adya suvite dadhātu Mūlaṁ nakṣatramiti yadvadanti
Prarācī vācā Nirṛti nudāmi śivam prajāyai śivamastu mahyaṁ

i.e., let this *nakṣatra* bestow welfare on us. I drive away what is called *mūla nakṣatra* (and its deity, viz., Nirṛti), by my recitation so that it may not turn back on us.

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(v) Another striking constellation is recommended in the Taittirīya Brāhmaṇā for a marriage ceremony:

Yāṁ kāmayet duhitaram priyā syāt.
Tāṁ Niṣṭhyāyām dadyāt[182]

i.e., if somebody wishes that his daughter be beloved to her husband, he should perform her marriage ceremony under Niṣṭhyā. Niṣṭhyā implies the Svātī constellation

(vi) According to the Taittirīya Brāhmaṇā,[183] if a king wishes to conquer his hitherto invincible enemy, he should march against his enemy under the constellation Abhijit. He will conquer the enemy miraculously, as if the enemy was defeated by his own fault.

We find a two-fold division of the constellations in the above mantra of the Taittirīya Brāhmaṇā as *Devanakṣatra* and *Yama nakṣatra.* The *kāmya* (optional) *karmas* ought to be performed under *deva nakṣatras* only.

Units of Time

According to the Śatapatha Brāhmaṇā[184] the year is divided into two solstices (*ayanas*) = 6 seasons = 24 fortnights = 12 months = 360 days = 360 nights = 720 days and nights = 10800 *muhūrtas* etc.

Also, we find a five-fold division of the day with respect to the position of the sun as *Udyansūrya, Saṅgava, Madhyandina, Aparāhṇa* and *Astamyan* in the Atharva Veda.[185] We find the subdivision of *muhūrta* in Śatapatha Brāhmaṇā[186] as follows:

1 *muhūrta* = 15 *kṣipras*
1 *kṣipra* = 15 *etarhis*
1 *etarhi* = 15 *idānis*
1 *idāni* = 15 *prāṇas*
1 *prāṇa* = 15 *aktanas*

So 1 *aktana* = $\frac{16}{16875}$ second seems to be the time unit.

Vedāṅga Jyotiṣa gives the following units:

5 *gurvākṣaras* or 10 *mātrās* = 1 *kāṣṭhā*
124 *kaṣṭhās* = 1 *kalā*
10 ($\frac{1}{20}$) *kalās* = 1 *nāḍikā*
2 *nāḍikās* = 1 *muhūrta*
30 *nygartas* = 1 day (i.e. the civil day)

Thus, in this system, the time unit is *mātrā* = $\frac{240}{2077}$ seconds.

MATHEMATICAL METHODOLOGY IN ANCIENT INDIA

The method by which numerals and place-value notation were invented in India is not now known; neither is the inventor's name. As Hogben wrote:[187]

> An inflexible numeration so crude as to make progress well nigh impossible, and a calculating device so limited in scope that even elementary calculations called for the services of an expert.... Man used these devices for thousands of years without making

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> a single worthwhile improvement in the instrument, without contributing a single important idea to the system... Even when compared with the slow growth of ideas during the dark ages, the history of reckoning presents a peculiar picture of desolate stagnation. *When viewed in this light, the achievement of the unknown Hindu, who sometime in the first centuries of our era discovered the principle of position, assumes the importance of a world event.* [Emphasis added]

But the free mention of fire-sacrifices (*yajñas*) in the Vedic hymns and, in the same way, the straight forward application of numerals and the counting process in the construction of fire altars shows that the ancient Indians had mastered numerals and the counting process at least before the period when the Vedic hymns themselves were revealed.

In the same way, the construction of various types of altars forces one to think that these people were experts in the construction of different geometrical shapes and their measurement. This is why we find fractions and even surds in the Śulba Sūtras. Extensions of altars necessitated mathematical operations like addition, subtraction, multiplication and, sometimes, division also and this indicates their thorough practice of these operations before the period of introduction of these extensions.

Further, transformation of one altar into another type compels one to accept the expertise of the ancient Indians in solving algebraic equations. This equation-solving process of the ancient Indians was transmitted to the western world through the work of Mohammed ibn Mūsā-al-Khawārizmī which is based on Brahmagupta's work. The Hindus kept their lead in solving the linear and quadratic equations. Later on, due to several reasons, the stream moved towards the west in the coming centuries and the credit for first solving equations of third and fourth degree went to them. In the attempt at solving equations of fifth and higher degree by radicals there emerged the so-called modern algebra through the works of Abel and Galois. But very few people know that the equation-solving technique itself was initiated by the ancient Indian sages thousands of years ago.

A similar history prevails with some other fundamental branches of recent mathematical sciences. While analysing inference components, the sage Gautama said, '*Sādhyasādharmyāt taddharmabhāvī dṛṣṭānta udāharaṇam*' (Nyāya Sūtra 1.1.36) and then regulates '*tadviparyayādvā viparītam*' (Nyāyasūtra 1.1.37) which, according to Vātsyāyana's commentary, means '*Sādhyavaidharmyādataddharmabhāvī dṛṣṭānta udāharaṇam*'. This indicates clearly the awareness of the sage of the following logical principle: '(A fact) "*P* implies (another fact) *Q*" is equivalent to "not *Q* implies not *P*"' and towards the set theoretic fact that 'if a set *A* is contained in a set *B* then the *B*-complement is contained in the *A*-complement'. But since the motivation of the sage was not to develop set theory or mathematical logic, he and his successors did not develop set theory, etc.

There was a mathematical way of thinking in ancient Indian civilization which is evident from the sūtra literature in which the savants are very particular about fixing the philosophical parameters in numbers, e.g., 12 *prameyas* in Nyāya, 9 *dravyas* in Vaiśeṣika, 4 categories (*Prakṛti, Prakṛti-Vikṛti, Vikṛti,* and *Anubhaya*) in Sāṅkhya etc. Thus, in ancient Indian civilization, mathematics played a vital role in almost every Vedic ritual, right from birth to death. Yet, since the motivation of the ancient Indians was not to write mathematical treatises, only the Vedāṅga Jyotiṣa is found among the earliest works of astronomy or mathematics. Certainly, there must have been works on mathematics and astronomy even before the Vedāṅga Jyotiṣa, as also between the Vedāṅga Jyotiṣa and the Āryabhaṭīya. The former is supported by the statement, '*Kālajñānam pravakṣyāmi Lagadhasya mahātmanaḥ*' (Ṛg. Jyotiṣa verse 2) which indicates that Śuci mentioned the Kālajñāna of his teacher Lagadha. But it is to be remarked here that Lagadha too must have gained the knowledge through some tradition which is indicated by the next verse 3 as:

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Viprāṇām sammataṁ loke yajñakālārthasiddhaye

Āryabhaṭṭa expresses it more obviously as:

Sadasajjñānasamudrāt samuddhṛtam Brahmaṇaḥ prasādena.
Sajjñānottamaratnam mayā nimagnaṁ swamatināvā—(Aryabhatiya, Golapāda, verse 49)

which means 'due to the grace of Brahmā, the precious gem of excellent knowledge has been brought out by me by means of the boat of my wisdom from the sea of *true and false knowledge* by diving deep into it.'

This indicates a situation resembling that of today: If some better book is published on a mathematical topic, the older ones are forgotten after a considerable span of time. Indeed, there must have been theories (apart from Jaina's canonical texts) in the pre-Āryabhaṭṭa era which were rejected or improved upon by Āryabhaṭṭa I and this is one of the main reasons behind the gap between the Vedāṅga Jyotiṣa and the Āryabhaṭīya. The other main reason seems to be the disturbance due to the invasions by foreigners like the Iranians, Greeks, etc. This situation was, unfortunately, again repeated after the twelfth century due to the Turkish invasions and, thus, the Indian savants were almost paralysed in their attempts to contribute further to original theories.

We conclude this article by indicating clues in the scriptures of ancient India of ancient Indian views on the time-space relation a topic which is considered to have evoked the most important discovery of this century in the field of mathematical cosmology.

THE CONCEPT OF THE TIME-SPACE RELATION AND SOME ALLIED CONCEPTS

The variation of time with respect to space has been a subject of deep curiosity since Einstein. But no concrete example could see the light of the day which could show two persons in different spaces recording different passages of time in a certain duration of the observer's calendar. The examples in this section, which are from Indian scriptures of the ancient period, signify the reality of Einsten's dream. The examples mentiioned in the following pages show that a human being, while in other space, e.g. Brahmaloka etc., experiences time according to the calendar of that space and that experience in the reverse order is also true.

According to the theory of relativity of time with respect to space (which is usually attributed to Einstein), during the course of the happening of a certain event, one observer's calendar may show a different span of time to that of another's. Naturally, a thinker will be curious to study an example of such a phenomenon practically. The following three paragraphs aim at presenting such examples from the Śrīmadbhāgavata (referred to as the Bhāgavata Purāṇa).

This text has an account of the following event:[188] In the period of the first Satyayuga of this Manvantara, there was a king Kakudmī ruling countries like Ānarta. Once he hailed to Brahmaloka in order to meet Brahmā, the Creator of all the universe and to seek help in taking a proper decision about a match for his daughter Revatī. He then saw the Creator busy in some function and being worshipped by Gandharvas and Kinnaras. After waiting for some minutes, till the song was over, he saluted Brahmā and started the conversation, stating his purpose. Brahmā then replied, 'Oh King! not only the persons whom you have proposed for the purpose, have ceased to exist but also their great-grand children are out of the race. (After your departure from that space) 27 *caturyugas* have elapsed, i.e. it is the 28th *tretāyuga* with respect to your departure from there. After leaving this place, when you reach there, it will be the 28th *dvāparayuga* and, consequently, Baladeva (Balarāma), a partial incarnation of God, will be an appropriate match.'

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This clearly explains why the author considers the difference in the 'Ages' of King Kakudmī and Revatī as negligible due to their presence in different 'spaces', viz., Brahmaloka and the earth. One can infer from this anecdote that the span of certain number of minutes of Brahmaloka is equal to a span of 27 *caturyugas* on earth. It must be noted here that one *caturyuga* equals 432×10^4 human years,[189] wherein *satyayuga* and *tretāyuga* cover, respectively, 1728×10^3 and 1296×10^3 human years[190] and the duration of a day in Brahmaloka is a span of one thousand *caturyugas*. Thus the duration of a song in Brahmaloka which appears to be more than 27 *caturyugas* (=11664×10^4 years) is, in fact, consistent since it is a span of about 20 minutes in that space. Such a span of a day in Brahmaloka is also described in the Gītā, wherein one reads, 'one thousand *caturyugas* form a day of Brahma'.[191]

In another incident,[192] it is narrated that King Mucukunda,[193] the son of Emperor Māndhātā hailed to the Space of the gods on their request to help save them from torture by demons. He fought a battle there against them and was victorious and lived there for several days in order to guard the gods until Kārtikeyasvāmi, their army chief, returned to his duties. At the moment of the king's departure, the gods said to him, 'Now your sons, queens, brothers, near-relations, intimates, counselors and the off springs of your time are no more, they have been victimized by death.' Here also, due to the presence of the King Mucukunda in another Space, we get, in the same manner, a significant variability in his age in the two spaces. It should further be noted here that the span of a day in the latter space is not so vast as that in the former one (it is merely 360 times that of a human day[194]).

Now we cite an example which shows that an inhabitant of Brahmaloka will experience time according to the human calendar if he would be translated to human space. It runs as follows:[195] In his boy-hood, once Lord Kṛṣṇa along with fellows entered a forest for grazing the cows. When he was taking lunch with his friends, Brahmā, in order to test Him, stole all the cattle. Sensing the uneasiness in the faces of the boys due to the disappearance of the cows, Kṛṣṇa consoled them and went in search of them. Meanwhile, Brahmā stole the boys too, kept them asleep in *his* space (Brahmaloka) by virtue of his *māyā* and after the duration of a *truṭi*, returned them to the spot from where he had stolen the cows. He then saw Kṛṣṇa playing with the same number of boys, having the same number of heads of cattle (the Lord had manifested Himself in the form of the boys and the cattle both in the same number):

Tāvadetyātmabhūrātmamānena truṭyanehasā
purovadabdaṁ krīḍāntaṁ dadṛśe sakalaṁ hariṁ [196]

It is to be remarked here that, according to the calendar of his space, Brahmā returned after a *truṭi* (=1/3240000th part of a second[197]), but on the earth he experienced that Kṛṣṇa had been playing for about one year.[198] Still more astonishing is the remark (which also supports the feeling of Brahmā in the reverse order) is that the boys who were returned after a year, experienced an extremely short span of time (in term of a very small fraction of a second) and shouted at once: '*Naikoapyabhoji Kavala ita aihītibhujyatām*',[199] which means 'we have not taken even a small morsel of food; come here and let us take food.' This shows that, in the duration of their stay at Brahmaloka, they were experiencing time according to the calendar of that Space. On the other hand, Brahmā, who returned after a *truṭi* according to His calendar, experienced the span of a year approximately on the earth (as soon as he came down to earth he experienced the passing of time according to the human calendar).

This makes it crystal clear that, if a species from Brahmaloka hails to human Space, it will experience time according to the human calendar and *vice versa*.

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THE AGE OF THE UNIVERSE

It is well known that one thousand cycles of *caturyugas* is the span of a day of Brahmā, which is also called a *kalpa*.[200] His night is also of that span. He creates the universe at the beginning of a *kalpa*.[201] It is also well known that the span of one *caturyuga* is 432×10^4 human years and so the span of a day of Brahnā works out to be 432×10^7 human years.[202] After a day of Brahmā, the world is annihilated,[203] which is called *pralaya*. In a day of Brahmā, fourteen *manus* have to pass.[204] The period of a *manu*, i.e. a *Manvantrara*, is, thus, a little more than 71 *caturyugas*.[205] Six *manus* have already passed and the present one is the seventh.[206] In the span of this seventh *manu*, 27 *caturyugas* have elapsed and we are now in the 28th cycle.[207] In this cycle, three *yugas* and 5095 human years of the present *yuga* (Kaliyuga) have passed. Thus, in this 28th cycle, 1728000 + 1296000 + 864000 + 5095 = 3893095 human years have passed. Hence the age of the universe according to Hindu scriptures is:

> 6 *manvantaras* + 27 *caturyugas* + 3 *yugas* of this cycle (i.e. *Kṛta, Tretā* and *Dvāpara*) + 5095 years of this *Kaliyuga* = 1955885095 human years.

It is to be noted here that, according to recent investigations by modern scientists, the age of the earth is of order 10^9 human years. It is remarkable that the Indian sages revealed this in the remote past while in Europe, a few hundred years ago, the age of the Earth was guessed (by counting the succession of Kings) as only 4000 human years!.

ABBREVIATIONS

B.S.	= Baudhāyana Śulbasūtra	*Āp.S.*	= Āpastamba Śulbasūtra
K.S.	= Kātyāyana Śulbasūtra.	*M.S.*	= Mānava Śulbasūtra

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CHAPTER XXVI

Vedāṅga Astronomy

S.N. Jha

In good weather, with a clear atmosphere, if one sits at night in the open air, one's attention is naturally drawn towards the sky where innumerable big and small stars twinkle. If they are observed continuously with concentration one might notice that some stars seem to move upwards and some downwards. Some of them look big and some of them look small. When we get up early in the morning just before sunrise, we notice a peculiar glow at the point at which earth and sky meet. Observing the sun rising from a particular direction every day, early man must have wondered about the beginning of creation and must have wanted to know more about this endless cycle. Perhaps he took the solid earth on which he stood for granted, but he must have wanted to find out about the sun, moon and innumerable stars which appeared each in its own place day to day from time immemorial. Natural phenomena such as sunrise, the sun's rays gradually spreading over the earth, the sun reaching its highest point in the sky at midday, the setting of the sun, the earth being covered with darkness, the appearance of the moon along with the stars and so on, must have roused his curiosity. People today, however, are not surprised by these happenings because they believe that with the knowledge we now possess all these can now be understood and explained. Who knows how many millennia mankind required to understand all this. The use of the terms like *sūryodaya* and *sūryāsta* implies that, in the beginning, people believed that the sun appears from the ocean in the morning and again dips into it, in the evening. The *Ṛgveda*[1] and the *Taittirīyasaṁhitā*[2] also hold a similar view.

Because of its seemingly erratic behaviour each fortnight, people must have been more intrigued by the moon than by the sun—sometimes it appears at dusk and sometimes it rises at midnight and midday also; sometimes the full moon is seen sometimes one can see it as a curved bright line and sometimes it disappears altogether only to reappear the next day as a raised horn which has been worshipped in the Ṛgvedasaṁhitā.[3] This New Moon increases in size day by day and gradually reaches the form of a Full Moon. The day when the Full Moon appears is popularly known as *pūrṇamāsa*. The term *māsa* in the word *pūrṇamāsa* refers to the moon. Thus, *pūrṇamāsa* denotes *pūrṇacandra*, full moon, as mentioned in the Ṛksaṁhitā[4] and Atharvasaṁhitā.[5]

The period from one full moon day till the next is designated as a *māsa*, a month. The term *pūrṇacandra* must have been used for *pūrṇamāsa* in the beginning. Consequently, it might have been conventionally used with reference to the completion of a month. The time might have been measured starting from the sunrise of one day till the sunrise of the next, which is technically known as *sāvanadina* in the Jyotiṣaśāstra. Such knowledge might have been gradually developed along with the general development of cultural activity.

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Man must have acquired the knowledge of *digdeśa,* direction and region, quite early, soon after conceptualizing the natural experiences of hunger and thirst which recur again and again, and which cannot be satisfied once and for all in any case.

Prehistoric man, needless to say, was a food gatherer and depended on rivers, lakes, streams and ponds for water. Food gathering and collection of water entailed movement from place to place and people must have naturally remembered those trees and streams from which they had satisfied their hunger and quenched their thirst. For going in search of those trees and streams etc., they would have remembered the directions in which they had gone from day to day. For the fixation of the direction as well as the region they would have taken the help of the direction of sunrise and sunset and recollection of the positions of big and remarkable trees and rivers etc. Therefore, it can be safely concluded that the knowledge of *Jyotiṣaśāstra,* which is based on direction, place, time etc., was more or less in the possession of common man. In other words, the simplest elements of astronomy are known to people even in the pre-Vedic age. The Vedic period, however, is considered as a fully developed period from every aspect, people were in possession of every branch of Śāstric and scientific knowledge. It is difficult to trace a subject which is *not* mentioned in the Vedas and Vedic literature. So far as the *Jyotiṣaśāstra* is concerned, although it has not been categorically mentioned in the Vedas, we find innumerable *ṛcās* where sun, moon and stars are eulogized or praised. The *Vedic ṛcās* are the edifice of the present *Jyotiṣaśāstra.*

In the introduction[6] to his *Vedāṅgajyotiṣa,* Shamashastri says that, from the study of the ancient texts of *Jyotiṣaśāstra* it seems that concepts like *sauramāsa, cāndramāsa, adhimāsa, kṣayamāsa* and *ayana* continue to be used in the same form today as they were in the Vedas and Vedic literature.

Balagangadhara Tilak[7] established many years ago that in the Vedic Saṁhitās, the shape and the nature of the collection of stars and *nīhārikās* are described along with the movement of the different planets and a scientific interpretation of their influence on earth. Thus, it becomes crystal clear from a study of the Vedas and Vedic literatures that the *Jyotiṣaśāstra* was fully developed in the Vedic age, though it had no independent existence as it has today. Almost all Indian historians hold a similar opinion in this regard.[8] On the other hand, David Pingree[9] describes this point very briefly in his work in the context of deciding the Vedic age and says that the basic elements of *jyotiṣa* are very much available in the Vedic literatures but, of course, they exist in an undeveloped form. However, I do not agree with Professor Pingree in this context. He has not rightly evaluated the astronomical elements contextually discussed in the Vedic literatures. My claim is based on the mantras to be mentioned in the following pages, which contain even the subtle topics related to *Jyotiṣaśāstra.* In fact, Veda does not belong to any particular branch of study. Therefore, it is not possible to find a detailed discussion of any *śāstra* in a particular place. However, contextually the main topics of all the *śāstras* are discussed in the Vedic mantras to some extent. Some of the topics are not mentioned, but that does not mean that the particular subject was not known to the Vedic people, since only such topics are covered in the Vedas as were necessary for the context.

TITHI

A thirtieth part of a *candramāsa* or the period equal to 12° *aṁśāntara* between the sun and moon, is called a *tithi.*[10] In the Vedas no clear evidence is available in this regard. In the Śatapatha Brāhmaṇa,[11] it is described that on new-moon day (i.e. *amāvasyā)* the moon descends on the earth and enters into animals, medicines and herbal plants. The Aitareya Brāhmaṇa,[12] however, holds a different view in this context. According to this text the moon enters (*anupraviśati*) the sun on a new-moon day, and, therefore, it is not visible on that

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particular day. On the names of the days or *tithis* of both the *pakṣas* (15 days each), śukla and kṛṣṇa are available in the Taittirīya Brāhmaṇa[13] where the fifteenth *tithi* is called *pūrṇamāsī* as is done today. From the above discussion it is clear that, in the Brāhmaṇa period, terms like *amāvāsyā* and *pūrṇamāsī* were very much in use as they are even today.

In the Tāṇḍya Brāhmaṇa,[14] there is a reference to twelve *amāvāsyās,* twelve *pūrṇamāsīs* and twelve *ekāṣṭakās.* The *ekāṣṭakā* is performed sometime in *māghakṛṣṇāṣṭamī* and sometime in *bhādra kṛṣṇāṣṭamī.* By *ekāṣṭakā,* generally the *aṣṭamī tithi* is understood. In the *Taittirīya Brāhmaṇa,* terms like *vyaṣṭakā* and *uddṛṣṭakā* are used for *kṛṣṇapratipada* and *śuklapratipada* respectively. Thus, it clearly seems that astronomy was a known science in the Vedic age also. In the Bahvṛca-Brāhmaṇa,[15] however, *tithi* is defined in a peculiar way, which does not appear sound conceptually. According to this Brāhmaṇa, *tithi* is that period in which both moon-rise and moon-set occur. In the Sāmavidhāna Brāhmaṇa,[16] there are references to *Kṛṣṇacaturdaśī, Kṛṣṇapañcamī* and *Śuklacaturdaśī.*

MĀSA

It is quite natural that *cāndramāsa* was in use in the *Vedic* age, because, *māsa,* is conventionally accepted as the meaning of month which is the denoter of *candra,* the moon. Therefore a *pūrṇimā* is otherwise termed a *pūrṇamāsī.* In fact, we have *candramā* as the easiest means of calculation of a *cāndramāsa,* which we unfortunately do not have in case of a *sauramāsa.* The knowledge of the beginning as well as the completion of a *sauramāsa* can be had only on the basis of mathematical calculation.

As was stated earlier, knowledge of *sāvanadina* might have been obtained well before *cāndradina* since it is very easy to calculate a day starting from sunrise and ending with sunset. This is how the *sāvanadina* is defined in the *Jyotiṣaśāstra.* On the other hand, the calculation of a *sāvanamāsa* is not that easy, because no such comfortable means is available for this purpose. But the case is different with the *cāndramāsa* because it can be calculated either from one full-moon day to another full-moon day, or from one new-moon day to another new-moon day. Therefore, justifiably, knowledge of a *sāvanadina* would have occurred first in the case of a day, whereas the knowledge of a *cāndramāsa* might have occurred first, so far as the month is concerned. In the *Ṛksaṁhitā*[17] there is reference to a context where it is said Varuṇa knows the animals produced in him and other things produced near him for twelve months. While paraphrasing this above *ṛcā,* Sāyaṇācārya explains things produced nearby as *adhimāsa,* which does not seem proper. But Shankar Balakrishna Diksit,[18] is of the opinion that modern scholars also support Sāyaṇa's view in this regard. Thirteen months are mentioned in the Taittirīya Brāhmaṇa.[19] In the *Taittirīyasaṁhitā*[20] also two more months, namely, *Saṁsarpa* and *Aṁhaspati* are mentioned, in addition to the popular twelve months.

While preparing a *pañcāṅga,* it becomes clear from mathematics that, whenever a *kṣayamāsa* occurs, it is always preceded and followed by an *adhimāsa.* Nowadays, the preceding *adhimāsa* is known as *saṁsarpa* and the following one is called *aṁhaspati.*[21] As per the statement, *asaṁkrānti-dvisaṁkrānti-saṁsarpāṁhaspatī samau,* of the Nāradasaṁhitā as heard from the oral tradition, *asaṁkrānti* i.e. an *adhimāsa* is designated *saṁsarpa* and *dvisaṁkrānti,* i.e. *kṣayamāsa* is designated *aṁhaspati.* Sāyaṇācārya[22] also explains *aṁhaspati* as *kṣayamāsa.* In the Vedic age, both the traditions, namely, *pūrṇimāntamāsa,* the month ending with the full-moon day, and *amāntamāsa,* the month ending with new-moon day, were in use simultaneously. From the Athrvanic mantra: *māso vai prajāpatiḥ tasya Kṛṣṇapakṣa eva rayiḥ śuklaḥ prāṇaḥ,*[23] it is established that in the Vedic age, the *kṛṣṇapakṣa* was considered as the first *pakṣa,* whereas the *śuklapakṣa* was considered as the consequent. In other words, the tradition of *cāndramāsa* was existing at that time. According to the Purāṇa, however, the gods were born

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in *śuklapakṣa* and the demons were born in kṛṣṇapakṣa. In the Taittirīya Brāhmaṇa,[24] it is said that the gods were born in the former *pakṣa*, whereas the demons were born in the later. In that particular context, it is further said that the former *pakṣa* is treated auspicious whereas the latter is considered inauspicious.[25] Although no direct statement is made with reference to *śuklapakṣa* and *kṛṣṇapakṣa* in this context, still researchers opine that the former *pakṣa* as *śuklapakṣa* and the latter as *kṛṣṇapakṣa*. The above statement favours the tradition of *amānta-māsa*. In fact, both the traditions exist today in day-to-day life.

The names of the months such as *Madhu*, etc., or *Caitra*, etc., are not available in the Vedas. These names are mentioned in the Brāhmaṇagranthas, but the intention is different. Here *caitra* does not refer to a month possessing a *pūrṇimā* associated with *citrānakṣatra*. Not long before Pāṇini's period, it was known that the moon always gets its full form in a *nakṣatra* only. Till that period, the names of the months like *Caitra*, etc., were already popular. Accordingly, Pāṇini has written his sūtra: *sāsmin paurṇamāsīti*.[26] In the Taittirīyasaṁhitā[27] also it is mentioned that the moon gets its full form in a particular *nakṣatra*. But it does not become clear whether the names like *Caitra* etc. were popular at that time or not.

VARṢA

Vasanta ṛtu, the spring season, is accepted as the face of the year; wherever in Vedic literature all the seasons are described together, the spring season is described first.[28] *Madhu* and *Mādhava* are accepted as the months of the spring season. In day-to-day life, sometimes the other seasons are, of course, also accepted as the first *ṛtu* of the year. But in the Vedas and Brāhmaṇagranthas the year always begins with the spring season.

DINA

The terms *dina* (day), and *rātri* (night), primarily refer to *sāvanadina*. The beginning of the day is marked by sunrise and the beginning of the night by sunset. The combination of such a day and a night is called a *sāvanadina* which is very much in practice now. According to Shankar Balakrishna Diksit,[29] neither the *Sauramāsa* nor the *Sauradina* is clearly stated in the Vedas. Rituals like *yāga*[30] etc. were performed as per the *sāvanadina* only. No doubt, the *cāndradina* is also mentioned in the Vedas, but, in addition to that, separate names are also available for each day and night of both the *pakṣas*.

DINAMĀNA

There is a eulogy in the Ṛgveda Saṁhitā,[31] where it is said, 'O Somarājan! May you increase my age (life) just as the sun increases the day.' It is clear from this *mantra* that the concept of *dinamāna* was fully known in the Vedic age. According to the *Dharmaśāstra*, the period between the sunrise and sunset or the period between the sunset and sunrise, is divided into 2, 3, 4, 5 and 15 divisions. Out of these five divisions, two divisions, namely, *pūrvāhna* and *aparāhna* are very common and acceptable to all. In addition to that, divisions like third,[32] fifth[33] and fifteenth[34] are mentioned in the *Ṛksaṁhitā* as well as the *Brāhmaṇagranthas*. In the Taittirīya Brāhmaṇa,[35] however, it is said that each and every *muhūrta* has 15 sub-*muhūrtas*. The auspicious and inauspicious *muhūrtas*[36] are also contextually mentioned at many places.

In the *jyotiṣa* texts, the ayanas are universally accepted as two. They are *uttarāyana* and *dakṣiṇāyana*. When the motion of sun is northwards, it is *uttarāyana* and when the movement

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of sun is southwards, it is accepted as *dakṣiṇāyana*. The *uttarāyana* and *dakṣiṇāyana* are decided according to the position of the sun. If the sun moves northwards from *makara-rekhā* then it is *uttarāyana* and if the sun moves southwards from *karkarekhā* then it is called *dakṣiṇāyana*. When the sun stays on the northern side of the *viśuvavṛtta*, it is day for the gods and when it resides in the southern part of the same *vṛtta*, it is considered to be night for the gods. In the Śatapatha Brāhmaṇa[37] it is said that the period when the sun stays in *uttara* (i.e. *vasanta, grīṣma* and *varṣā ṛtus*), it is called *uttarāyana*. But this statement is not very clear.

No clear statement is available in the Ṛksaṁhitā about the *ṛtus*, but the Taittirīya Saṁhitā[38] mentions six *ṛtus*. In the Brāhmaṇagranthas[39] also five *ṛtus* are mentioned. In the Śatapatha Brāhmaṇa[40] there is a reference to three *ṛtus*. In the Taittirīyasaṁhitā[41] the wheel of the seasons (*ṛtucakra*) begins with the spring season.

While discussing *kalpa* in his *Bhāratīyajyotiṣa*, Shankar Balakṛṣṇa Dikṣita[42] says that *kalpa*, which is described in post-Vedic *jyotiṣa* texts, is not mentioned in the Vedas. Moreover, *kalpa*, which is used in the other sense, i.e., *kālamāna*, is also not mentioned in the Vedas.

The term *yuga*[43] has been mentioned in many places. Sāyaṇācārya[44] explains terms like *yuge* and *yugāni* mentioned in the *ṛcās* of the Ṛksaṁhitā as *kṛta, tretā* etc. Elsewhere[45] also the term *yuga* is mentioned in many places in the sense of *kāla*. But nothing is stated with reference to the extension of *yuga*. An interesting point is to be noted here that in the *Vedāṅgajyotiṣa*,[46] the extension of *yuga* is accepted as of five years. The names of the *yugas* like *kṛta, tretā*[47] etc. are contextually mentioned in the Vedic texts but they are not clearly explained.

Amongst the *navagrahas*, the sun and the moon are contextually mentioned in innumerable places in all the Vedas, however, the names of Rāhu and Ketu in any Veda except the Atharva. Although the term *pañcatārā graha* is not categorically mentioned in the Vedas, *pañcatārā grahas* like *bhauma* etc. are nevertheless mentioned in the sense of names of deities. In many contexts it is stated in the Vedas that the five deities (pañcadeva)[48] move around in the sky.

The *grahas* like *Guru*[49] and *Śukra*[50] are separately mentioned in the Vedas. Names like *Rāhu, Ulkā* and *Dhūmaketu* are mentioned only in the Atharvasaṁhitā.[51] Till the Atharvanic period, the celestial globes were already known as *grahas*. Knowledge of *grahaṇa*, solar eclipse, did exist in the Vedic period. There is a reference to *grahaṇa* when the earth is covered with darkness,[52] in Vedic as well as Brāhmaṇa texts. But it is not clear whether the cause of an eclipse was known to them or not, The Taittirīyasaṁhitā[53] goes one step further when it says that moon is illumined by the light of the sun. The description of various *nakṣatras* is available in many *ṛcās* of the Ṛksaṁhitā.[54] However, the names of all the *nakṣatras* are available only in the Taittirīyasaṁhitā[55] and the Taittirīya Brāhmaṇa.[56]

On the basis of the above discussion, it can be safely concluded that the science of astronomy was in a developed stage in the Vedic as well as the post-Vedic age. If a particular topic is not discussed in the Vedas, that does not necessarily mean that such subjects were not known to the Vedic people, because, by closely observing the Vedic texts, we find that if a particular topic is omitted in a particular text, it is discussed in other texts and the topics which are discussed in a particular text, are also omitted in other texts. For example, there is a reference to *grahaṇa* in the Ṛksaṁhitā but the names of the *nakṣatras* are not available there, whereas in the Taittirīyasaṁhitā, the names of the *nakṣatras* are mentioned but there is no reference to solar eclipses.

In the post-Vedic age, i.e., in the Vedāṅga period, the six Vedāṅgas—*Śikṣā, Kalpa, Vyākaraṇa, Nirukta, Chandas* and *Jyotiṣa*—came into existence. Thus, each and every Veda has these six *aṅgas*. While studying their own Vedas along with the *sakhas*, the Vaidikas started reading the six *aṅgas* also. May be all the six *aṅgas* of all the Vedas were available in the beginning. But today, except for the Kalpasūtras the other five *aṅgas* are the same for all Vedas.

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The tradition expressed in the popular statement: *Ṣaḍaṅgo vedo dhyeyeḥ jñeyas ca*,[57] is alive only in the case of Ṛgvedic Brahmins.

Jyotiṣa is a prominent member amongst the six *aṅgas* of the Vedas, of which *Vedāṅgajyotiṣa* is accepted as the first and foremost work, consisting of only 36 verses composed by Lagadha muni.[58] In addition to that, a separate work called *Vedāṅgajyotiṣa* is also available, consisting of 43 verses, on which Somakāra[59] has written a commentary. At the end of this commentary, an important statement is quoted, which is as follows: *Iti śrī śeṣakṛtam jyotirvedāṅga-bhāṣyam samāptam.*[60]

This work is famous as the *Yajurvedāṅgajyotiṣa*. In addition to that, a third work called *Vedāṅgajyotiṣa* is also available which is popularly known as the *Atharvajyotiṣa*. This work is completely different from the two above mentioned works. The *Atharvajyotiṣa* is comprised of 14 *prakaraṇas* and 162 verses. Although no concrete evidence is available on whether or not these three treatises on *Vedāṅgajyotiṣa* were being studied by the Vaidikas, the Vedāṅgajyotiṣa, consisting of 36 verses, famous as the *Ṛgjyotiṣa*, is still being studied in the circle of Ṛgvedis, which is not surprising. The Vedāṅgajyotiṣa on which the commentary of Somākara is available, is widely known as *Yajurvedāṅgajyotiṣa*. On the other hand, the third *Vedāṅgajyotiṣa*, which is different from the former two, is absolutely a separate work, widely known as *Atharvajyotiṣa*. Thus, it will be quite appropriate if these three works are named *Ṛgjyotiṣa*, *Yajuryotiṣa* and *Atharvajyotiṣa*, as was done by Śaṅkara Bālakṛṣṇa Dikṣit. Twenty-nine verses of the *Yajurvedāṅgajyotiṣa* are identical, word to word, to verses in the *Ṛgjyotiṣa*, except for their serial order. In contrast, only 13 verses are available in the *Yajurvedāṅgajyotiṣa*, which are available neither in the *Ṛgjyotiṣa* nor in the *Atharvajyotiṣa*. Therefore, only these 13 can be considered to be original contributions of the *Yajurvedāṅgajyotiṣa*. However, there is a reference to one shared verse where the meaning is similar in both the cases but the word-construction and the metre differ from each other. Thus, if counted jointly, excluding repetitions, the total number of verses of the *ṚK* and *Yajurjyotiṣa* will be 49 (29 + 1 + 6 + 13). The following table will clarify the real position of the verses in both the texts:

ṚK Jyotiṣa	*Yajurjyotiṣa*
Verses No. 1	Verses No. 1
2	0
3	2
4	13
5	6
6	7
7	8
8	9
9	10
10	15
11	19
12	27
13	0
14	18
15	17
16	38
17	24
18	39
19	0
20	22

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21	21
22	40
23	41
24	42
25	32
26	33
27	34
28	35
29	0
30	43
31	23
32	5
33	0
34	0
35	4
36	3

Yajus	*ṚK*
1	1
2	3
3	36
4	35
5	32
6	5
7	6
8	7
9	8
10	9
11	0
12	0
13	4
14	0
15	10
16	0
17	15
18	14
19	11
20	0
21	21
22	20
23	31
24	17
25	0
26	0
27	12
28	0
29	0
30	0
31	0
32	25

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33	26
34	27
35	28
36	0
37	0
38	16
39	18
40	22
41	23
42	24
43	30

TIME FIXATION

Western scholars,[61] like their Indian counterparts, have fixed the time of the Vedāṅgajyotiṣa as follows: *Uttarāyana* is accepted in Vedāṅgajyotiṣa only if the combination of sun and moon occurred in the beginning of whatever becomes the dividing place of the *Dhaniṣṭhā* by accepting the Revatī star as the starting point of the *nakṣatracakra*. From this statement it becomes clear that the place of the *Dhaniṣṭhā Yogatārā* appears in the beginning of the *Dhaniṣṭhā* division, which is factually not correct. In fact, the place of *Dhaniṣṭhā Yogatārā* is 4°.11′ farther from the starting point of the divisive *Dhaniṣṭhā*. Since only one point of the *Sampātagati* is possible in 72 years, 4°.11′ *gati* will be possible in approximately 301 years. Accordingly, the time fixed by the *Vedāṅgajyotiṣa* will go ahead by 300 years. *Uttarāyana* occurs only after the nine sign (*rāśi*)—*Sāyanabhoga* of the sun and the moon. Since *Uttarāyana*[62] had occurred in the beginning of *Dhaniṣṭhā*, the measure of the *Sāynabhoga* of *Dhaniṣṭhā* is naturally proved to be nine signs (*rāsi*). Scholars like Colebrooke,[63] Keropant, etc., accept Alfa Delfini as Yogatārā amongst the stars divisive of *Dhaniṣṭhānakṣatra*. Although Pandit Bapudev Shastri has accepted this view while translating the Sūryasiddhānta, still, just like Whitney,[64] he has accepted Beta Delfini as *Yogatārā* in his *Pañcāṅga*. Most probably, he has been influenced by Whitney in the later stage. The *bhoga* of Beta Delfini is one degree (*aṁśa*) less than that of the Alfa Delfini.

In 1989, when I was at Puri (Orissa), I had calculated its *bhoga* as 10°/17°/13′/29′. According to this calculation, the difference has come to one *rāśi*, 17 *aṁśa*, 13 *kalās* and 29 *vikalās*. If the *gati* of one *aṁśa* takes 72 years, then the *gati* of above mentioned *aṁśa* etc. will take place in about 3384 years. Since the year begins at 1395 (3384 – 1989 = 1395), 9 *rāśi-sāyanabhoga* of *Dhaniṣṭhā* comes before 1395 years. Therefore, this (1395 BC) should be accepted as the period of the *Vedāṅgajyotiṣa*. If Beta Delfini is accepted as Yogatārā, as Professor Whitney does, the difference may come to 72 years. Then also the time of the *Vedāṅgajyotiṣa* can be accepted as the fourteenth century BC. In the introduction to *Vedāṅgajyotiṣa*,[65] Shamashastri has also accepted the fourteenth century BC as the time of the *Vedāṅgajyotiṣa*. According to Professor A. Weber,[66] the names of the *nakṣatras* in the *Vedāṅgajyotiṣa* have been taken from modern texts and it also contains the names of the zodiacal divisions (*rāśis*) like *meṣa* etc. But, I feel, this view is mistaken as neither the names of the *nakṣatras* in this text are modern, nor does it contain the names of the *rāśis*. It only contains the name of *Śraviṣṭhā*[67] amongst the *nakṣatras*. According to the *Yajusjyotiṣa*,[68] there are nine names of *nakṣatras* and of them *Aśvayuk* is an old name. Moreover, the term *Aśvini* has not been used in this work. The rest of the names are old and have been taken over word by word even in modern texts. In the *Ṛgjyotiṣa*[69] two old names, *Aśvayuk* and *Śatabhiṣak* are available. Therefore, the views of

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Professor Weber, accepting the date of the present work as the fifth century, on the basis of the names of the *nakṣatras* and the *rāśis*, needs a second thought.

PLACE

In the calculation of *dinamāna* and *rātrimāna* it is said that, in *uttarāyana* length of the day increases and that of the night decreases to the time of *prastha* every day; and that in *dakṣiṇāyana*, the changes are vice versa. Between these two *ayanas*, the increment and decrement in the day and night is about six *muhūrtas* i.e. 12 *ghaṭis*.[70] If the increment is of six *ghaṭis* in the day, then the corresponding night is decreased by six *ghaṭis* and if the increment of six *ghaṭis* occurs in the night, then the day is decreased by an equal amount of time. Thus, it is clear that in the beginning of *uttarāyana*, *dinamāna* is: 30 – 6 = 24 (*ghaṭīs*) and in the beginning of *dakṣiṇāyana* the *dinamāna* is 30 + 6 = 36 (*ghaṭīs*). Therefore, the half day (*dinārdha*) will be of 12 and 18 *ghaṭis* respectively. The *carasaṁskāra* will be of 3 *ghaṭīs* and in *c.* 1400 BC the *paramakrānti* of the sun was 23°.53′.

Now *Akṣāṁśa*	=	*Carabhujaya* × *Krāntikoṭisparśarekhā*
Cara	=	3 *ghaṭīs* = 18°
Log of *bhujaya* of 18°	=	9.89982
Log of *Krāntikoṭisparśarekhā* of 23°.53′	=	10.353801
Therefore *Akṣāṁśa*	=	34°.54′.6″ = 34° 55′.

From the above statement it becomes clear that the *dinamāna* of *Vedāṅgajyotiṣa* belongs to a place where the *akṣāṁśa* is 34°/55′ i.e. Peshawar. Therefore, it can be assumed that, most probably, the present text was composed in that particular region.

No solid evidence is available to decide the date of Somākara. The name of Somākara is not available in any other text or commentary of *jyotiṣa*. Two commentaries of his on the *Yajurvedāṅgajyotiṣa* are available of which one is very small and the other is somewhat elaborative. In the abridged commentary, neither the name of Somākara nor his colophon like a *śeṣakṛtayajurvedāṅgajyotiṣa* are available. Only on the basis of his style and word-construction, is it inferred that this commentary must have been written by Somākara. On the other hand, in the elaborate commentary, the name of Somākara appears in the beginning of the text and the colophon contains the statement: *Śeṣakṛtajyotiṣaśāstrabhāṣyam samāptam.* Both the commentaries are very simple and explain only the simple and comprehensive verses. If they would have explained all the verses, then it would have been of immense help to readers and the researchers for comprehending the exact meaning of the texts. Since the nature of this work differs from that of other *jyotiṣa* texts, it has been quoted in none of the *jyotiṣa* treatises. Inspite of this fact, this work is very important from the historical point of view.

DIFFERENT EDITIONS

According to available records, this work, with Somākara's commentary was edited, and published for the first time by Professor A. Weber[71] from Berlin in the year 1862, entitled *Uberden Vedakalender names Jyotiṣam.* Later, in 1877, Professor G. Thibaut published this work with an English translation in the *Journal of the Asiatic Society.*[72] In this edition he has presented a very good explanation of six important verses which had not been explained earlier. In 1881, Śaṅkara Bālakṛṣṇa Dikṣit translated, into Marathi, all these verses, which had already been explained by Professor Thibaut. After that, this important text has been explained by

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Kṛṣṇaśāstri Goḍbole, but he has not explained the verses which were left unexplained by his predecessors.

J.B. Modak[73] has translated both the *Ṛg*and *Yajurvedāṅgajyotiṣa* into Marathi (published from Thane, Maharashtra) in 1885. In his *Bhāratīyajyotiṣa*, Dikṣit[74] says that he has explained the meaning of eight more verses, in addition to the 28 verses which had been explained till Professor Thibaut's period. From this statement it can be inferred that Somākara has explained the meaning of only 19 verses and Professor Thibaut explained six more from rest of the verses (19 + 6 = 25). J.B. Modak has explained three more (25 + 3 = 28) and S.B. Dikṣit has explained eight more verses to help the tally reach 36 (28 + 8 = 36). Thus, in all, 36 verses have so far already been explained.

Bṛhaspatyalāla (Chhotelal) edited a version of the whole text of the *Vedāṅgajyotiṣa* which was published in the *Hindustan Review* in 1907. Dr Sudhākara Dikṣit published the same text with a Sanskrit commentary from Varanasi in 1908. After that Muralidhar Jha has contributed *Laghuvivaraṇa* in Sanskrit and explanatory-notes in English on this work, which is a very useful contribution. The English commentary of Sudhakar Dvivedi's edition was published in 1936 from Mysore by Shamshastri.[75] The edition published in the *Hindustan Review* was republished in 1960 from Allahabad. Professor David Pingree[76] has brought out original information on this work in 1973 in the *Journal of the History of Astronomy*. Currently, this work is being published with English Notes from the Bharatiya Vedavidya Pratisthan, Delhi. Shitesa Chandra Bhattacharya has also edited and published his work, the details of which are not so far available to me. [However, I once came across this book once in the library of the Sadashiv Kendriya Sanskrit Vidyapith at Puri.]

The *Yajurvedajyotiṣa* is generally not prescribed in the syllabus of any course. It is felt by scholars that the *Vedāṅgajyotiṣa* which is being studied today, is full of *ārṣaprayogas*, and, therefore, cannot be explained with the rules of Sanskrit grammar. Some are also of the opinion that since the real meaning of these verses are not approachable due to their toughness, they are treated as *ārṣaprayogas*. This text is definitely a post-Vedic work, so far as its language is concerned. Each and every *Vedāṅga* has different seers. Lagadhamuni is accepted as the seer of *jyotiṣa*, just as Pāṇini and Piṅgala are the seers of *Vyākaraṇa* and *Chandas* respectively. This has been stated in the second verse of this text itself:

Praṇamya śiraṣā kālam abhivādya sarasvatīm/
Kālajñānam Pravakṣāmi Lagadhasya Mahātmanaḥ//[77]

YUGA

In the first[78] verse of *Ṛgjyotiṣa* there is a discussion about a *yuga* which is of five years. But no reference is available to the names and *adhipatis* of these five *yugas*. On the other hand, while explaining the ninth and tenth verse of the *Yajusajyotiṣa*, Somākara has quoted 16 verses of Garga,[79] where the names of the five *Samvatsaras* and their *adhipatis* are mentioned, in addition to many other subjects. The *Samvatsaras* and their *adhipatis* (written against their names) are as follows:

1. *Saṁvatasara*—Agni, (2) *Parivatsara*—Āditya, (3) *Idāvatsara*—Vāyu, (4) *Anuvatsara*—Candramā and (5) *Idvatsara*—Mṛtyu (Yama).

However, the number, order and the names of these *Saṁvatsaras* along with their *adhipatis* differ in the Bṛhat-Saṁhitā,[80] Taittirīya Brāhmaṇa[81] and Vājasaneyīsaṁhitā,[82] etc.

Somākara in the *Bhāṣya* of the first verse, has explained the meaning of *śuci*,[83] as pure in speech, thought and body—*Vāṅmanaḥ-Kāyaśuddhaḥ śuciraham*, whereas Mahā-Mahopādhyāya Sudhākara Dvivedī[84] has explained of *śuci* as a name (*abhidhāna*).

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PARVAN

Just as in the texts composed in the *Siddhānttakāla*, there is a tradition of computing *ahargana*[85] for computing the position of the planets (*grahas*), similarly, in the *Vedāṅgajyotiṣa*, the explanation of parvānayana[86] is quoted. In the *Ṛgjyotiṣa* the reading is dvādaśārdhābda, whereas in the *Yajurjyotiṣa*, the reading *gatasaṁyutam* is found in place of *dvādaśābhyasta* and *gatisaṁjñaka*. In accepting this reading the meaning becomes explainable. Although the term parvan simultaneously denotes *aṣṭamī, caturdaśī, amāvāsyā, pūrṇamāsa* and *saṁkrānti*, still this particular *sūtra* of *Vedāṅgajyotiṣa* can only be justified if the term parvan denotes *amāvāsyā* and *pūrṇimā* alone is accepted in texts like the Sūryasiddhānta,[87] etc.

PARVĀNAYANAVIDHI

Parvānayanavidhi is stated in both the texts, *Ṛg* and *Yajurjyotiṣa*. Although the wording of the verse in both the texts is similar, the explanations of the scholars differ. In his Preface to the Vedāṅgajyotiṣa, Bṛhaspatyalāla Chhotelal[88] says: 'I need not quarrel with Mr Dikṣit, though I consider my own explanation better'. But M.M. Muralidhar Jha criticized both Bṛhaspatyalāla Chhotelal and S.B. Diksit in the appendix of M.M. Dvivedi's edition. He says: 'Owing to their defective knowledge of Hindu astronomy both of them explained this verse in a wrong way.[89] While citing an example, Professor Jha says: 'Suppose we require to know the total number of parvans elapsed since the beginning of the lustrum up to and excluding the tenth month of the fourth year', there would be different answers.

According to Dikṣit[90] and Chhotelal,[91] the answer to this example comes as 94 *parvans*, whereas per the view of M.M. Sudhākara Dvivedī[92] and Muralidhar Jha[93] it comes as 95 *parvans*.

Chhotelal has presented the following sūtra[94] of his own in this context: The number of *parvans* elapsed up to and excluding the *y*th parvan of the *x*th calendar year $[(x-1) \times (12 \times 2 + 2 + Y) \times (1 + 2/60)]$. According to this rule, the result of the above example will come as 95 + 1/15. But Muralidhar Jha differs from this view, criticizing it as clearly wrong. In analysing the above discussion without any prejudice, it seems that the views of Sudhakar Dvivedi and Muralidhar Jha are justifiable. The *Bhāṣya* of Somākara[95] also generally supports the view of these two, but like Sudhākar Dvivedi and Muralidhar Jha, he does not present the conceptual justification.

THE SYSTEM OF *UTTARĀYANA* AND *DAKṢIṆĀYANA*

When the sun and the moon are confluenced in the *dhaniṣṭhā nakṣatra, uttarāyana* begins.[96] In the sixth verse of the *Ṛgjyotiṣa*[97] it has been made more clear that in the beginning of *Dhaniṣṭhā*, i.e. in the month of *Māgha*, the *uttarāyana* begins and in the middle of *Aśleṣa*, i.e., *Śrāvaṇa*, the *dakṣiṇāyana* begins. This view is also expressed in the Bṛhatsaṁhitā[98] and Sūryaprajñapti,[99] viz., that it was the previous practice. In the period of *Bṛhatsaṁhitā*[100] it was accepted that, in the second quarter of *Uttarāṣāḍha*, the *uttarāyana* begins and in the fourth quarter of *Punarvasu*, the *dakṣiṇāyana* begins. On the other hand, in the commentary of *Sūryaprajñapti*[101] and in *Kālalokaprakāśa, dakṣiṇāyana* is accepted in the *Puṣya-nakṣatra*. But now-a-days,[102] the beginning of *uttarāyana* is accepted in the half of *mūla nakṣatra*, and the beginning of *dakṣiṇāyana* in the middle of *ārdrānakṣatra*. At the time of the *Vedāṅgajyotiṣa*, the beginning of *nakṣatracakra* was accepted from *Kṛttikā*. Accordingly, the place of *dhaniṣṭhā* becomes 21st in the order and the *Sāyanabhoga* is possessed of nine *rāśis* in the beginning of

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dhaniṣṭhā. On the other hand, today the *nakṣatracakra* begins with *uttarabhādra*. As a result, the *mūla nakṣatra* becomes the 21st one, possessing *Sāyanabhoga* of nine *rāśis*.

PARIMĀṆA[103]

In this context, it is said that 50 *palas* = 1 *ādhaka*. The term *droṇa* is also used in this text but its quantity is not described. Bhāskara[104] and Varāha[105] have described its quantity which is discussed in detail in the Appendix of *Meghamālā*[106] and can be summed up as follows :

50 *palas* = 1 *ādhaka*, 4 *ādhaka* = 1 *droṇa* = 200 *palas*, 4 *prastha* – 1 *ādhaka* = 50 *palas* :: 1 *prastha* = $13\frac{1}{2}$ *palas*, 4 *kudavas* = 1 *prastha* = $12\frac{1}{2}$ *palas* :: 1 *kudava* = $3\frac{1}{8}$ *palas*. The value[107] of 33 *naḍīkas* = *droṇa* = 3 *kudavas* :: 1 *droṇa* = 20 *palas* = 64 *kudavas* :: 64 *kudavas* – 3 = 61 *kudavas* :: 1 *kudava* = $3\frac{1}{8}$ :: 61 *kudavas* $\times \frac{25}{8} = \frac{1525}{8}$ *palas* :: $12\frac{1}{2}$ *pala* = 1 *prastha* :: $\frac{1525}{8}$ *palas* $= \frac{61}{4}$ *prastha* 1 *nāḍī* $= \frac{61}{4}$ *prasthas*

The highest value of *vṛddhi* and *hrāsa* is six *muhūrtas* and the *madhya mamāna* of *muhūrta* is two *nāḍīs*.

:: 6 *muhūrtas* = 6 × 2 = 12 *nāḍīs*.

If 1 *nāḍī* = $\frac{61}{4}$ *prastha* then 12 *nāḍīs* $= \frac{61 \times 12}{4} = 183$ *prasths*.

The middle of two *ayanas* and *sāvanadina* = *sauravarṣasāvanadinārdha* $= \frac{366}{2} = 183$. Thus, if 183 *prasthas* are increased in 183 *sāvanadinas* then the ratio will be 1 *prastha* in 1 *sāvanadina*. Therefore, the statement goes as: *Gharmavṛddhirapām Prasthaḥ*.[108] So far as the meaning of this statement is concerned, all the scholars hold a similar opinion.

DINAMĀNA[109]

The above mentioned order of increment and decrement in the length of a day and a night can also be justified with the *sūtra* quoted below, which is meant for proving the *dinamāna*:

$\frac{1}{61}$ *the number of days desired*[110] *from the beginning of uttarāyana* × 2 + 12 = *Dinamāna* in the form of *muhūrta*.

In one place[111] the increment is said to be one *prastha* in one day, while in another,[112] the quantity of *prastha* is stated as $\frac{4}{61}$ *nāḍīs*. Here also the increment is $\frac{4}{61}$. Only for the convenience in multiplication and division, 61 *kudavas* are accepted as equal to 1 *nāḍī*.

ADHIMĀSAŚEṢA

In each *parvan* an excess of a half moon-day remains and the rest of all the *parvans* is known as *ṛtuśeṣa* or *adhiśeṣa*. The time falling between two *parvans* is called *ardhacandramāsa*. In a *yuga*, consisting of five years, there are 1830 *sāvandinas*, 120 *ardhasauramāsa* and 124 *parvans*. Thus,

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in a half *candramāsa* (i.e., 1 *parvan*) there are $\frac{1830}{124} = 14\frac{94}{124}$ *sāvanadinas*, and in a half *sauramāsa*, there are $\frac{1830}{124} = 15\frac{1}{4}$ or $15\frac{31}{124}$ *sāvanadinas*. Thus, in each *parvan*, there are $15\frac{31}{124}$ *sāvanadinas*. $15\frac{31}{124}$, $14\frac{94}{124} = \frac{61}{124}$ *sāvanadinas*, i.e., half of the *candratithi* remain in excess. In 60 *parvans*, this *māna* becomes $\frac{61}{124} \times 60 = 19\frac{64}{124}$ *sāvanadina*, which is equal to one *candramāsa*. Therefore, one *adhimāsa* becomes possible in 30 *candramāsa*. This influence is also visible in the concepts of Bhāskara, etc. *Bārhaspatyalekha*, the commentary of Chotelal, is different and inconsistent also.

NAKSATRA

The order of the *nakṣatras* is not mentioned in this text. However, in some of the verses the names of 27 deities are mentioned,[113] which are the lords of the *nakṣatras* like *Kṛttikā*, etc. Thus, it becomes clear from these verses that the order of the *nakṣatras* started from *Kṛttika* and not from *Aśvini* at that time. In treatises like Taittirīyasaṁhitā,[114] Taittirīya Brāhmaṇa[115] and Atharvasaṁhitā[116] also this order is accepted. Most probably the present text of the *Vedāṅgajyotiṣa* has been influenced by the above-mentioned texts.

The order of 27 *nakṣatras*, beginning with *Aśvinī* etc., which is in use today, is as follows: *Aśvinī, Bharaṇī, Kṛttikā, Rohiṇī, Mṛgaśirā, Ārdrā, Punarvasu, Puṣya, Aśleṣā, Maghā, Pū-phā, Uphā, Hasta, Citrā, Svātī, Viśākhā, Anurādhā, Jyeṣṭhā, Mūla, Pūrvāṣāḍha, Uttarāṣāḍha, Śravaṇā, Dhaniṣṭhā, Śatabhiṣā, Pūrvabhādra, Uttarābhādra* and *Revatī*. Which was the real order in the vedāṅga period is not clearly known. But after the correction of the reading of verse 14 of the *Ṛgjyotiṣa*[117] and the verse 18 of the *Yajuṣjyotiṣa*,[118] the following become clear:

1. Symbols are used for the names of the *nakṣatras*. For some, the initial letters of the *nakṣatras* are used; for some others, the last letters; and sometimes the last letters of their presiding deities.
2. If the order of these two texts is compared with the order beginning with *Aśvinī* and ending with *Revatī* as mentioned above, then it becomes clear that between the two lists there is a running difference of six ordinal positions. That means, if the *Aśvinī* is accepted as the first *nakṣatra* in the order then *Ārdrā*, which comes at number six, will be the second and the third will be *Pūrvaphālguni* which is sixth to *Ārdrā* and so on.

1. *Jau*	= *Aśvayujau*	2. *Drā*	= *Ārdrā*
3. *Gaḥ*	= *Bhagaḥ—Pūrvaphālguni*	4. *Khe*	= *Viśākhe*
5. *Śve*	= *Viśve(devā)—uttarāṣāḍha*	6. *Hih*	= *Ahirbuhanyaḥ = uttarābhādrapada*
7. *Ro*	= *Rohiṇī*	8. *Ṣā*	= *Aśleṣā*
9. *Cit*	= *Citrā*	10. *Mū*	= *Mūla*
11. *Saḥ*	= *Śatabhiṣak*	12. *Nyah*	= *Bharaṇyaḥ*
13. *Su*	= *Punarvasu*	14. *Mā*	= *Aryamā=uttarāphālguni*
15. *Dhā*	= *Anurādhā*	16. *Naḥ*	= *Śravaṇaḥ*
17. *Re*	= *Revatī*	18. *Mṛ*	= *Mṛgaśirṣa*
19. *Ghā*	= *Maghā*	20. *Svā*	= *Svātī*
21. *Pam*	= *Āpapūrvāṣāḍha*	22. *Aja*	= *Ajaskapāda=Pūrvabhādrapada*
23. *Kṛ*	= *Kṛttikā*	24. *Syah*	= *Praṣyah*
25. *Ha*	= *Hastaḥ*	26. *Jye*	= *Jyeṣṭhā*
27. *Sthā*	= *Śraviṣṭhā (= dhaniṣṭhā)*		

In fact, the justification behind this peculiar order (leaving four *nakṣatras* in between) is not known. The utility of such an order is also not found in other related verses. S.B. Dikṣit[119]

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has tried his best to justify this order, but I am not convinced by his arguments. In fact, it seems that he himself is not very much convinced with his own statement, while he says, this is because some of the related verses might have been lost. Now-a-days, a person is named in the order of *cucecola* as per the *nakṣatra* in which he is born. But it was different in the vedāṅga period.[120] The *saṁkalpas* of the sacrifices were performed by the names which were adopted on the basis of the letter of the *nakṣatras* related to the deities for whom the sacrifices are performed.

No clear statement is available about *māsapati*,[121] but it is stated that if the first day of the present *candramāsa* is Sunday, then the first day of the next *candramāsa* will be Tuesday, because a *candramāsa* is generally of 29 days. Thus, $\frac{29}{7} = 1$ + the first day of the next month 1 + 1 = 2. That means, the first day of the coming month will be after a gap of one day. Sudhākar Dvivedi[122] says, if the first day of the present *candramāsa* is Sunday, then the first day of the next *candramāsa* will be Monday. But this view needs a second thought, because this cannot be proved practically.

SŪRYANAKṢATRĀNAYANA[123]

The number of *parvans*,[124] starting from *yugādi* till today, should be multiplied by 11, and the number of days after the *parvan* should be multiplied by 9. The *parvans* which are multiplied by eleven, should be added to the days multiplied by nine. The result of the addition should be divided by 124, and the result should be added to the number of last *parvans*. The final result will come as the present *sūryanakṣatras* in the desired *tithyanta*. This system is meant for the *yugas* consisting of *pañcasaṁvatsaras*, because only then can the above *sūtras* be justified. In one *yuga*, the number of *sūryanakṣatras* are 27 × 5 = 135, and *candraparvas* are 124.

In calculating the ratio where *ravinakṣatra* is *y* and *parvan* is *p*, we have 124 *parvans* = 135 *ravinakṣatra* and the ratio $\frac{135}{124} = y + \frac{11y}{124}$. Since one *parvan* is equal to 15 *tithis*, if the *māna* of *ravinakṣatra* become $\frac{135}{124}$ then, in *iṣṭatithi*, the *ravinakṣatramāna* related to the *iṣṭatithi* $\frac{135 \times iti}{15 \times 124} = \frac{9 \times iti}{124}$. If both are combined then the *māna* of *ravinakṣatra* from *yugādi* $P + \frac{11P + 9\ iti}{124}$. Therefore, from the calculations of *dhaniṣṭhā*, etc., the *sūryanakṣatra* will come on the present *tithi*.

In modern texts also, violent and cruel *nakṣatras* are described, but this is not symmetrical with *vedāṅgajyotiṣa*. For example, according to *vedāṅgajyotiṣa*, *Ārdrā*, *Citrā*, *Viśākhā*, *Śravaṇā*, and *Aśvayuk* are violent (*ugra*) *nakṣatras*, whereas *Maghā*, *Svātī*, *Jyeṣṭhā*, *Mūla* and *Bharaṇī* are cruel. However, in modern *muhūrta* texts, there is no difference between *ugra* and *krūra*, while only *Maghā* and *Bharaṇī* are described as *ugra* or *krūra*. *Ārdrā*, *Mūla* and *Jyeṣṭhā* are described as *tīkṣṇa* or *dāruṇa*, *Citrā* is described as *mṛdu*, *Viśākhā* as *miśra*, *Śravaṇa* and *Svāti* as *cala* and *Aśvayuk* is described as *laghu* or *kṣipra*.

The accomplishment of the Atharvanic rituals is prescribed in the *Atharvavedāṅgajyotiṣa* in the version of conversation between Brahmā and Kaśyapa. The informations about the additions and publication of the *Atharvavedāṅgajyotiṣa* is not available elsewhere. Shri Chhotelal Sharma and Om Narayana Dvivedi published it with Hindi translation in 1965 from the Pitambarapith Parisad, Vanakhandesvara, Datiya. This edition contains a very brief publisher's note by Pt. Lalita Prasad Dvivedi, Assistant Secretary of the Parisad and a foreword by Shri 1008 Shri Svamiji Maharaj, where it is mentioned that the manuscript of this book was obtained from Atharvavedic Scholar Shri Visnubhatta Gore,[125] Gwalior, Madhya Pradesh.

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Shankar Bālakrishna Dikṣit has not said anything in this regard.

This particular edition contains 14 chapters and 162 verses. However, an additional verse is also available immediately after the 162nd verse numbered as 166.[126] In his Foreword Svamiji Maharaj says that this book is comprised of 162 and 166 verses.[127]

S.B. Dikṣit had discussed this 162nd verse in his *Bhāratīyajyotiṣa.*[128] Svamiji Maharaj does not say anything about the availability of verses 163-5, although the present edition does not contain them. Skipping over three verses in the text cannot be interpreted as a printing mistake. Therefore, from the above discussion it can be inferred that this particular book contains 163 verses and the scribe might have unknowingly made a blunder by numbering the last verse 166 instead of 163.

In no manuscript is the title of the book mentioned as *Atharvavedīyavedāṅgajyotiṣa.* Only on the basis of the statement: *āmnāyavidhidarśanāt,* appearing in the last verse of this book, might it have been guessed that this *vedāṅgajyotiṣa* belongs to *Atharvaveda.* The above view has been supported by Shankara Bālakrishna Dikṣit also.

In closely observing the subject matter of this book, it does not seem that it is as old as other *vedāṅgas* and *vedāṅgajyotiṣas.* However, it does not contain the names of 12 *rāśis.* From this, somehow, its oldness can be inferred but it cannot be accepted as a fact, because the names of seven days available in this book go against this inference. The following prominent topics have been covered by this book: *Kālaparimāṇanirṇaya, muhūrtavivaraṇa;* the bad and good results of *muhūrtas;* the merits of performing journeys on auspicious days; the designation of *tithis* and their *phalādeśa;* the estimation of works according to the days; the designation of *nakṣatras* and their classification; the calculation of *gaṇas* on the basis of *nakṣatras* and their merits and demerits; the merits and demerits of the *tithis* with reference to *rajasvalā* along with *garbhādhāna* and so on.

All the above-noted topics have been incorporated in the *phalitajyotiṣa* of today. The twelve *rāśis* (zodiacs), namely *Meṣa, Vṛṣa,* etc., are not mentioned in this book just as in the *Ṛk* and *Yajusajyotiṣa.* The names of the 27 *nakṣatras* like *Kṛttikā,* etc., are also not available in this book. However, it describes nine groups of *nakṣatras,* each of them containing three *nakṣatras.* In fact, in Vedic time, the counting of *nakṣatras* starts from *Kṛttikā*[129] as it is available in the Atharvaveda.

NOTES AND REFERENCES

Translated from the original Hindi by Dr Banmali Biswal.

1. *Yad devā yatayo yathā bhuvanānyapinvata /*
   atrāsamudra āgūlhamā sūryamajabhartana/ / Ṛv. 10.72.7.
2. *Ya udagānmahato'rnavādvibhrājamānaḥ salilasyamadhyāt/*
   Sa mā Vṛṣabho rohitākṣaḥ sūryo vipaścin manasā punātu/ / Tai. Sam
3. *navo navo bhavati jāyamāno'hnāṁ keturuṣasāmetyagram/*
   bhāgam devebhyo vidadhātyāyan pracandramā stirate dīrghamāyauḥ// ṚKsaṁhitā 10.85.19.
4. *sūryamāsā mitha uccarātaḥ*—Ibid., 10.68.10
5. *Sūryamāsā vicarantā divi,* Atharvasaṁhitā 20.16.10.
6. Introduction to *Vedāṅgajyotiṣa,* ed. Shamashastri, pp. 1-16.
7. B.G. Tilak, *Orion or Researches into the Antiquity of Vedas,* 1893, pp.1-9. This has been quoted in Vacaspati Gairola, *Sanskrit Sāhitya kā Itihāsa.*
8. (*a*) S. Dvived, *Ganakataraṅgini,* ed. S. Shukla, Sampurnananda Sanskrit University, Varanasi, pp.1-2, (Here this point is not directly mentioned but implied); (*b*) Baladev Upadhyaya, *Sanskrit Śāstron Kā Itihāsa,* Chapter, II, p. 55; (*c*) Vacaspati Gairola, op. cit., pp. 666-7; (*d*) Lokamani Dahal, *Jyotiṣaśāstrasyetihāsa,* p. 5.
9. *History of Sanskrit literature* (Gen. Editor Jan Gonda), Vol. VI Fax 4; D. Pingree, *Jyotiṣaśāstra,* p. 9
10. *Siddhāntaśiromaṇi,* madhyamādhikāra, bhaganādhyāya, V.13
11. Śatapatha Brāhmaṇa 1.6.4.5.

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12. Aitareya Brāhmaṇa 40-5
13. Taittirīya Brāhmaṇa 3.10.1.1., 3.10.10.2
14. Tāṇḍya Brāhmaṇa 10.3.11.
15. Quoted in S.B. Diksit, *Bhāratīyajyotiṣa*, tr. Shivanath Jharkhandi, p. 58.
16. Ṛksaṁhitā 1.25.8.
17. Ṛksaṁhitā 1.25.8.
18. *Bhāratīyajyotiṣa*, Hindi ed., tr. Shivanath Jharkhandi, p. 38.
19. Taittirīya Brāhmaṇa 2.10.1.
20. Taittirīyasaṁhitā 1.4.14.
21. Muhūrtacintāmaṇī 1.47.
22. Taittirīyasaṁhitā 1.4.14.
23. Sṛṣṭiprakaraṇa of the Atharvaveda.
24. Taittirīya Brāhmaṇa 2.2.3.1.
25. Ibid. 3.10.4.1.
26. 4.2.29.
27. Taittirīya saṁhitā 7.4.8.
28. Śatapatha Brāhmaṇa 2.1.3.
29. *Bhāratīya Jyotiṣa*, op. cit., p. 56.
30. Taittirīya Brāhmaṇa 3.10.1.1., 3.10.1, 2-3.
31. Ṛksaṁhitā 8.48.7.
32. Taittirīya Brāhmaṇa 3.12.9.1.
33. Ṛksaṁhitā 5.66.3; Taittirīya Brāhmaṇa 1.5.3; Śatapatha 2.2.309; Śrautasūtra 3.12.
34. Tai. Bra. 3.10.1.
35. Ibid., 3.10.9.9; 3.10.1.4.
36. Ṛksam. 7.88.4; Tai.Sam. 6.1.4.4; Tai.Bra. 1.1.2, 1.5.2 and 1.8.4.
37. Śatapatha Brāhmaṇa 2.1.3.
38. Taittirīyasaṁhitā 4.3.2, 5.6.23; 7.5.14.
39. Taittirīya Brāhmaṇa 2.7.10; Aitareya Brāhmaṇa 1.1.
40. Śatapatha Brāhmaṇa 3.4.4.17.
41. Taittirīyasaṁhitā 1.1.2.6-7, 3.10.4.1.
42. *Bhāratīyajyotiṣa*, Hindi edn., p. 30.
43. Ṛksaṁhitā 10.72.2, 1.10.3.4.
44. Ibid.
45. Ṛksaṁhitā 5.52.4; 5.73.3; 1.158.6; 6.8.5; 10.69.1; Vājasaneyīsaṁhitā 12.75, 12.111.
46. *Vedāṅgajyotiṣa*, v.1.
47. Taittirīyasaṁhitā 4.3.3; Vājasaneyīsaṁhitā 30.18; Taittirīya Brāhmaṇa 1.5.11, 3.4.1; *Aitareya* Brāhmaṇa 33.15.
48. Ṛksaṁhitā 1.105.10, 10.55.3.
49. Ibid., 4.50.4; Attarvasaṁhitā 20.88.4; Tai.Bra 2.8.2., 3.1.1.
50. Ṛksaṁhitā 10.12.3; Śatapatha Brāhmaṇa 4.2.1; Taittirīyasaṁhitā 1.2.5.
51. Atharvasaṁhitā 19.9.
52. Ṛksaṁhitā 5.40 Tāṇday Brāhmaṇa 4.5.2., 4.6.13, 4.6.8, 14.11.14, 23.16.2.
53. Taittirīyasaṁhitā 3.4.-7.1.
54. Ṛksaṁhitā 10.68.11, 10.85.1, 10.85.13, 5.54.13, 10.64.9, 4.51.47.
55. Taittirīyasaṁhitā 4.4.10.
56. Tai.Bra. 1.5.1.
57. Mahābhāṣya (*MBh*), ed. F. Kielhorn, Vol. I, 1962, p. 1.
58. Ṛk (Vedāṅga) Jyotiṣa, verse 2, Ed. Sudhakara Dvivedi, p. 61.
59. Yajus (Vedāṅga) Jyotiṣa, *Somakara Bhāṣya*, Verse 2, Ed. Sudhakar Dvivedi, p. 2.
60. The variant reading: *Iti Śrī Śeṣāṅgakṛtaṁ Jyotiṣaśāstrabhāṣyam samāptam*, is also available.
61. *Bhāratīyajyotiṣa*, S.B. Dikshit, trans. Sivanath Jharakhandi, p. 123, where the views of Colebrooke and others are discussed.
62. Bṛhatsaṁhitā, 3-1, 2 ; Ṛk 6.
63. *Bibliothica Indica*, New Series, Vol. I., 1860.
64. Sūryasiddhānta, trans., Vergesa, p. 211.
65. Shamshastri, *An Introduction to Vedāṅgajyotiṣa*, Rajakiyasakha Press, Mysore, 1936, p. ii.
66. *Bhāratīyajyotiṣa*, op. cit., p. 127

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67. Ṛgjyotiṣa, Verse 6.
68. Yajusajyotiṣa, Verse 33.
69. Ṛgjyotiṣa 14.
70. *Gharmavṛddhirapām prasthaḥ kṣapāhrāsa udaggataue/*
Dakṣiṇato Viparyāsaḥ Sanmuhūrtyanena tu//Ṛgjyotiṣa-7, Yajusjyotiṣa-8.
Yad uttarasyāyanato gatam syācchesam tathā dakṣiṇātoyanasya/
tadekāṣaṣṭhyā dviguṇam vibhaktam sadādaśam syāt divasapramānam//—Ṛj-22; Yj-40.
71. David Pingree, op. cit., 10.
72. *Journal of the Asiatic Society*, Vol. 46, 1877, pp. 411-37.
73. David Pingree, op. cit. p. 10.
74. S.B. Diksit, *Bhāratīyajyotiṣa* (Hindi edition), p. 95.
75. Published from Rajakiyasakha Mudralaya, Mysore.
76. David Pingree, op. cit. p. 10.
77. Ṛgvedāṅgajyotiṣa-2, this verse is not available in the Yajurjyotiṣa.
78. *Pañcasaṁvatsaramayam yugādhyakṣam Prajāpatim/*
Dinartvayanamāsāṁgaṁ Praṇamya Śirasā śuciḥ/—Ṛgjyotiṣa-1, Yajusa-1.
79. Yajusajyotiṣa, ed. Sudhakara Dvidevi, pp. 14-5.
80. *Saṁvatsarogniḥ parivatsaro'rkaḥ idadikaḥ sitamayrkhamali/*
Prajāpatiśca pyanuvatsardh syadidvatsaraḥ sailasutapatiśca//—Bṛhatsaṁhitā 8.28
81. *Agnirva saṁvatsaraḥ, ādityaḥ parivatsaraḥ, candramā idavatsaraḥ, Vāyuranuvatsaraḥ*—Tai.Br. 1.4.18.
82. *Saṁvatsaro si Parivatsarosidavatsarosidvatsarosi vatsarosi*—Vā. Sam. 36.45. Here, there is a difference in the order and names of 4th and 5th ones.
83. Sudhakara Dvivedi, Yajusajyotiṣa, p. 2.
84. Ibid.
85. Sūryasiddhānta 1.48-51, Siddhāntaśiromaṇī, Grahānayanādhyāya, 1-3, The number of civil days elapsed during any interval of time—Editor.
86. *Nirekam dvādaśārdhābdam dviguṇam gatasaṁjñikam/*
Ṣaṣṭhyā ṣaṣṭhyā yutaṁdvābhyām parvanām rāśirucyate//Ṛgjyotiṣa -4, p. 62; Yajus-13, p. 20. Ed. S. Dvivedi.
87. *Sūryasiddhānta, candragrahaṇādhikāra,* verse 8, p. 465, Ed. Bhasyakara Mahabir Prasad Shrivastava.
88. Preface to B.L. Chhotelal, *Vedāṅgajyotiṣa.*
89. Appendix of Professor Muralidhar Jha, *Yajusa* and *Arcajyotiṣa*
90. S.B. Diksit, *Bhāratīyajyotiṣa* Hindi edn., p. 99.
91. Chhotelal, *Jy. Vedāṅga*, p. 41.
92. *Yajus Archa Jyotiṣa*, Sudhakar Dvivedi Edn., pp. 21-2
93. Ibid., Pariśiṣṭa by Muralidhar Jha, pp. 90-1.
94. Chhotelal, *Vedāṅgajyotiṣa*, p. 41
95. Sudhakara Dvivedi, *Yajus ArchaJyotiṣa*, pp. 21-2.
96. *Svarārkameke, somārkau yadā sākaṁ savāsavau/*
syattadādiyugam māghastapaḥ śuklo'yanaṁ hyudak//—Ṛkjyotiṣa 5, p. 62; Yajusjyotiṣa-6, p. 7 (ed. Sudhakara Dvivedi)
97. *Prapādyete śraviṣṭhādau sūryacandramāsayudak/*
Sāpārdhe dakṣiṇārkastu māghaśrāvaṇayoḥ sadā/—Ṛkjyotiṣa-6, p. 62; Yajus-7, p. 8, ed. Dwivedi.
98. *Aśleṣārdhāddaksinamuttaramayanam raverdhaniṣṭhāyām nūnam kadācidāsidyenoktan pūrvaśāstreṣu*—Bṛhatsaṁhitā 3.1, p. 79, ed. A.B. Tripatay.
99. *Sūryaprajñapti* (of Jainas), ed. Malayagiri, p. 163.
100. Bṛhatsaṁhitā 3.2, Ed. A.B. Tripatay, p. 79.
101. *Sūryaprajñapti*, Comm. Jaina Acarya Malayagiri, p. 94.
102. Sūryasiddhānta, Comm. Mahavir Prasad Srivastava, p. 259.
103. Yajurjyotiṣa, 24, p. 39, Ṛkjyotiṣa 17, p. 64, Ed. Sudhakara Dvivedi
104. Līlāvatī 8, Ed. Dayanath Jha, Mithila Vidyapith, p. 1.
105. Bṛhatsaṁhitā, Pravarsanādhyāya 2.
106. Meghamālā, Ed. S.N. Jha, G.N. Jha, K.S. Vidyapith, Allahabad, p. 20.
107. Yajurjyotiṣa 24, p. 38; Ṛgjyotiṣa 17, p. 64, Ed. Sudhakara Dvivedi.
108. Yajusajyotiṣa 8 , Ṛgjyotiṣa 9, ed. Sudhakara Dvivedi.
109. *Tadekaṣaṣṭhyā dviguṇam vibhaktam sadvādaśam syād divasapramānām*—Ṛgjyotiṣa 22, p. 66, Yajurjyotiṣa 40, p. 45, ed. Sudhakara Dvivedi
110. *Yaduttarasyāyanato gataḥ syāccheṣam tu yad dakṣiṇātoyānasya.* (The immediate prior day to the day of which the *dinamāna* is to be proved, should be understood as the desired day.)

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111. Ṛj. 7; Yj 8.
112. Ṛj 17; Yj 24.
113. *Agniḥ prajāpatiḥ somo rudroditibṛhaspati /*
Sarpāśca pitarāścaive bhagaścavaryamāpi ca //
Savitā tvaṣṭātha vāyuścandrāgnimitraeva ca/
Indro niṛṛtirāpo vai viāvedevastathaiva ca //
āhibadhnyāstathā pūṣā aśvinau yama eva ca //—Ṛj 25-20, p. 66; Yj-32-4, pp. 49-50; ed. S. Dvivedi.
114. Tai. Sa. 4.4.10.
115. Tai. Br. 1.5.1.
116. A.V. 19.7 (here the number of *nakṣatras* is 28).
117. *Jau drā ghaḥ khe śve hī ro ṣā cin mūṣā ṇyaḥ sūmā dhānaḥ*
re mṛghā svā po jaḥ krsyo ha jyeṣṭhā ityrkṣa liṅgaiḥ.—Ṛj p. 64 (comm. of S. Dvivedi).
118. *Jaudrāghaḥ kheśvehī roṣā cinmūṣāṇyaḥ sūmādhānaḥ*
re mṛghā svāpojaḥ krsyoha jyeṣṭhā ityrkṣaliṅgaiḥ—Yj p. 30 (*Sudhākarabhāṣya*).
119. *Bhāratīyajyotiṣa* (with Hindi trans. of Shivanath Jharakhandi) p. 104.
120. Ṛgyotiṣa 28, p. 66, Yajusjyotiṣa 35, p. 50, ed. Sudhakar Dvivedi.
121. *ekantarehni māse ca pūrvan kṛtvā dimuttaraḥ/*
ardhayoḥ pañcavarsānām mṛdu pañcadaśā - stamau//Yajusajyotiṣa 11, pp. 1-6 (Ed. S. Dvivedi).
122. Ibid, p. 16.
123. *Ekādaśabhir abhyasya parvāni navabhis tithim /*
Yugalabdham saparva syātvartamānār kabhakramāt//—*Yj* 25, pp.40-1 (ed.S. Dvivedi).
124. *Parvānayanavidhi*, Yajusajyotiṣa.
125. Atharvavedāṅgajyotiṣa, Pt. Chhotelal Sharma, 1965, p. 6.
126. Ibid., p. 64.
127. Ibid., p. 6.
128. *Bhāratīyajyotiṣa*, Hindi edition, translated by Shivanath Jharkhandi, p. 37.
129. *Suhavamāgne kṛttikā rohiṇī cāstu bhadram mṛgaśiraḥ śamārdrā/*
Punarvasu sūnṛtācārū puṣyobhānur aśleṣa ayanam magha me//—AV 19.7.2.

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CHAPTER XXVII

Development of Āyurveda from Antiquity to AD 300

P.V. Sharma

1. PREHISTORICAL AGE

Āyurveda (the science of life) emerged with the evolution of life itself and, as such, it is not possible to trace its beginning. Likewise, it is also impossible to predict its end as it will continue as long as creation lasts. Caraka, therefore, rightly says that Āyurveda is *śāśvata* (traditionally eternal) as it has no beginning (*anādi*).[1] The same idea is expressed when the origin of Āyurveda is traced to Brahmā (the Creator) but even then it must be clarified that 'origin' does not imply 'emergence of existence' but only that it was known and revealed. Thus, the origin of Āyurveda denotes only knowledge and revelation and not 'coming to existence'.

Suśruta goes even further and states that Āyurveda was revealed by the Creator even before the creation.[2]

All this points to the fact that Āyurveda goes back to prehistory, back to a point which is difficult to trace. Āyurveda emerged with life, when living beings emerged they were conscious about their health and the maintenance of life. Primitive man collected his food from Nature and was quite hale and hearty. Whenever he fell ill, he took some root or leaves of plants and recovered. Though prayers and magic were prevalent, the internal and external uses of drugs cannot be ruled out. In the Palaeolithic Age, man was a hunter and collected his food and drugs from the environment. In the Neolithic Age, man learnt cultivation and began to grow food crops,[3] of which some might have been drugs too but most probably drugs were collected from plants in the wild state. It would not be unreasonable to infer that stone implements were used to cut the bark and leaves and to dig out roots. It is also possible that some plant materials were pounded or crushed on stone slabs to extract juice or make pulp or powder, which makes the basic pharmaceutical forms.

2. INDUS VALLEY CIVILIZATION

By the time we come to the Indus Valley Civilization (2500-1700 BC), the tradition of Āyurveda was much developed. The attitude of people towards health and sanitation was very advanced, which is evident from the systematic town-planning at Harappa and Mohenjo-daro. The

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maintenance of public wells, bathrooms and an efficient drainage system contributed to the robust health of the inhabitants.[4]

Evidences are found that the people then used drugs from all the three sources—vegetable, animal and mineral, as they have been found in the remains. Tree-worship was enshrined in the way of life which indicates that great importance was attached to plants and plant materials in human life. On this basis, it may be presumed that vegetable drugs were more commonly used than animal products and minerals as observed even in the earliest *saṁhitās* of Āyurveda. It is to be noted that none of the fifty groups of drugs described in the *Caraka-saṁhitā* (*CS*) contains animal products or minerals, though in the *Suśruta-saṁhitā*(*SS*) such drugs are mentioned.

Among the animal products, stag-horn and cuttlefish bone were found in the excavations at Harappa and Mohenjodaro. Most probably, they were used as drugs as they are popular remedies even in present times. *Śṛṅga-bhasma* (ash of stag-horn) is an efficacious and popular drug for cardiac pain and respiratory disorders, while *samudraphena* (cuttlefish bone) is useful in diseases of the ear. Presumably, conch-shell (*śaṅkha*) was also used as a drug after preliminary processing.

Among inorganic substances, *śilājatu* has been found in the remains which indicates that it might have been a drug of choice for the people of the Indus Valley Civilization.[5] *Śilājatu* has been popular on the subcontinent as an effective drug for promotion of strength and as a remedy for a number of disorders for thousands of years now. Trephined human skulls and curved knives, found in excavations indicate that, probably, surgical measures were also practised.[6]

Great emphasis was laid on personal hygiene and a *dinacaryā* (daily routine) was perhaps prescribed which emphasized cleanliness and purity. Miraculous powers were attributed to water not only because of its use for outward cleanliness but also as a vehicle for maintaining physiological body fluids. The Great Bath of the Harappans is a symbol of the importance they attached to water for health.

It is also observed that various methods of sudation prescribed in illness were in practice and also the anointment (*abhyaṅga*) of the body. Some cosmetics were also used by the Indus people, including collyrium (*añjanas*) for which metal rods (*añjana-śalākā*) made of copper and bronze were used. Use of collyrium prevents and cures eye diseases.

The Indus people wore seals depicting animals and other amulets to ward off evil spirits (*bhūtas*). This was documented in later texts as one of the measures under spiritual treatment (*daiva-vyapāśraya cikitsā*) and has served as the nucleus for *bhūtavidyā*, one of the eight *aṅgas* (parts) of *Āyurveda*.

There are evidences to show that the worship of Lord Rudra and a Mother Goddess was prevalent in the Indus Valley Civilization. It may be noted that Lord Rudra is regarded as the first physician among the gods (*prathamo daivyo bhiṣak*).[7] This indicates that he preceded the Aśvins, the twin god-physicians of the Vedic age, and, thus, may be taken as a symbol of the physician in prehistoric times. It may be mentioned here that the mythical origin of *jvara* (fever), the foremost among diseases, relates to Lord Rudra[8] and, in its treatment too, Lord Rudra, along with the Mother Goddess, is propitiated when drug therapy fails.[9] Rudra is also a symbol of *prāṇa* (life)[10] and it is consistent that he is associated with the times when life emerged.

Casually it may be said that Rudra, the Aśvins and Dhanvantari represent the prehistoric, Vedic and Purāṇic ages respectively.

Thus, it can be clearly observed that Āyurveda existed even in prehistoric times and was developed, to a certain extent, at the time of the Indus Valley Civilization.

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3. VEDIC PERIOD

Saṁhitās

The Vedas, believed to be the eternal source of knowledge and wisdom, had wide ramifications. The four *saṁhitās*, a number of *Brāhmaṇas*, *Upaniṣads* and *Kalpasūtras* constitute the Vedic literature. Besides, there are *Upavedas* and *aṅgas*.

Āyurveda is generally taken to be an *Upaveda* of the Ṛgveda or the Atharvaveda. Caraka does not mention it as an *Upaveda* but only states that we should be attached more to the Atharvaveda as it deals with medicine in many ways.[11] Suśruta has mentioned it as an *upāṅga* of the Atharvaveda.[12]

In fact, the tradition of Āyurveda has been running parallel to the Vedas from time immemorial. Kaśyapa says Āyurveda, as the fifth Veda, is superior to all of them. Initially, it was only in the form of *śruti* and *smṛti* on the theoretical side and in that of a number of remedial measures on the practical side. The knowledge and practice were not documented but were only reflected in the contemporary literature. At that time, medical practice was empirical and a theoretical base had not yet been constructed. There were no *saṁhitās* on Āyurveda but we have a glimpse of the development of Āyurveda, in theory and practice, as reflected in Vedic *saṁhitās* particularly of the Ṛgveda and Atharvaveda.

In *RV*, prayers are offered to the gods for bestowing good health and warding off diseases. Among the gods, Indra, Sūrya, Rudra, Agni, Varuṇa and the Maruts were popularly worshipped.

Indra is described as a *bhiṣak* (physician). In one of the hymns he is invoked to destroy *kṛmis* infesting a child.[13] The legend of Apālā and Indra's treatment of her illness is interesting and has been related as follows:

> Apālā, the daughter of Atri, who suffered from skin disease was abandoned by her husband and thus lived in her father's hermitage performing penance for Indra. Once she thought that, since *soma* was liked by Indra, she would offer it to him and, with this idea, went to the river's bank. While returning after taking bath she found *soma* on the way. She began to chew it and the peculiar sound this made attracted Indra who was so fascinated that he sucked the *soma* juice from Apālā's mouth. He was very pleased and asked Apālā what he could do for her. She requested Indra kindly to cure her father's loss of hair and her sterility along with her skin disease. Indra did so and finally, to treat the skin disease, dragged her through the hole in the chariot's wheel thrice by which the outer diseased layers of her skin were removed and thus she was made beautiful, acquiring the glow of the sun.[14]

This indicates the extent to which ideas about these diseases had developed.

Sūrya is the source of cosmic energy and destroys diseases like *hṛdroga*, jaundice, leucoderma and leprosy. Prayers are offered to Him for longevity and healthy life. He is said to be the *prāṇa* of the people.[15]

Rudra, as mentioned earlier, is the god who has been worshipped since prehistoric times as the first godly physician who provides remedies for men and animals.[16]

Agni, by virtue of his intense power, destroys pathogenic agents and is therefore also called a *bhiṣak* and a *bheṣajakartā* (maker of drugs). He is invoked to destroy evil agents and to provide health and happiness.[17]

Varuṇa is the lord of cosmic order and controls the movement of the water principle. He has been eulogized as a physician who knows thousands of drugs and has been prayed to provide health and happiness.[18] By Varuṇa's wrath, King Hariścandra suffered from ascites,[19] which again proves Varuṇa's association with the water principle. Even today, the plant *varuṇa*

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(*Crataeva nurvala* Buch. Ham) is a popular remedy used in the retention of urine and renal stones.

Prayers are offered to the Maruts to destroy the disorders of *vāta* and to provide health and happiness. They are mentioned as knowers of all drugs growing on river banks and on mountains.[20]

The most popular and expert physicians of the Vedic age were the Aśvins, the twin gods, who excelled in both medicine and surgery. Obviously they seem to represent the two old schools of medicine and surgery which, in the later age, were represented by Ātreya and Dhanvantari. They were also experts in plastic surgery, transplantation of organs and measures of resuscitation. The Ṛgveda is replete with accounts of the miraculous feats of the Aśvins,[21] the most outstanding of which is the rejuvenation of Cyavana, an old sage. This gained them recognition and regard and, like Indra, entitlement to a cup of *soma*.[22] A similar anecdote is found in *SS* according to which they are said to have been recognized by the gods as master surgeons after a successful transplantation of the head of *yajña*.[23]

These instances indicate the elevation of the physician's status in the social order in remote antiquity. The concept of the ideal healer is well defined in *RV* as follows: The scholar, knower of herbs, is the physician who destroys *rakṣas* (evil agents) and diseases.[24] This suggests the following:

1. The physician was a learned man.
2. He was well acquainted with the identification of drugs as well as their properties and actions.
3. He had to manage patients on two fronts—magical and medical—and, as such was expected to be expert in both spiritual (*daivavyapāśraya*) and medical (*yuktivyapāśraya*) treatment. (In the Vedic age the former had the upper hand while in the post-Vedic era the latter gained prominence though both are recognized in *CS*.)

The Atharvaveda exhibits much advance in this direction. There is an obvious increase in the number of diseases and drugs mentioned in it. With the Kauśikasūtra, it throws ample light on the status of medicine at that time. Some of the names of diseases found in *AV*, such as *kṣetriya, jāyānya, takman* and *balāsa* are quite peculiar and these did not continue to be used in the post-Vedic era; others like *yakṣman, hariman, hṛdroga, kṛmi, kāsa, kilāsa,* and *jalodara,* have survived and are used even today. *Hariman* became *halīmaka* later, while a new word *kāmalā* was coined for jaundice. Besides, there are names like *vātikāra, kṣipta, āsrāva* and *grāhi* which still baffle identification.

Methods of treatment, apart from prayers and offerings, consisted of the following:

1. *External application*: Drugs were applied externally as paste.
2. *Internal administration:* For example, the intake of milk boiled with *lākṣā* in cases of acute injury.
3. *Mechanical intervention*: Such as catheterization in cases as retention of urine.
4. *Surgical operation*: Such as puncturing of glands, obstetrical operations, treatment of wounds, plastic surgery, and orthopedic management.
5. *Use of natural remedies*: These involved sun-rays, fire, water and air.[25]

Though a number of diseases were defined and their treatment undertaken, the basic concept of *tridoṣa* was in formative stage in the Vedic period. It was not as systematized and well-defined as in the Āyurvedic *saṁhitās*. The word *tridoṣa* is not found in the Vedas and *tridhātu*,[26] though often mentioned, is interpreted differently, though Sāyaṇa almost invariably interprets it as *vāta-pitta-kapha*. *Vāta* comes earliest in *RV*,[27] *pitta* in *AV*,[28] but *śleṣman* (*kapha*) is mentioned first in the Śatapatha Brāhmaṇa.[29]

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Knowledge of anatomy also developed during the period of *SB*, though the names of organs of the body are found in *RV* and *AV* also. Probably in the course of sacrifices, animals were dissected and their organs identified. *SB* describes 360 bones (including teeth and nails) which make up the skeleton of the human body.[30] Caraka mentions and follows this tradition of the Vedavādins while Suśruta adopts a different course, accepting a count of only 300 bones. In this scheme, teeth and nails are rejected but cartilages are retained as they are treated as a type of bone.

Brāhmaṇas

The Jaiminīya Brāhmaṇa, apart from other measures, prescribes the *Cakṣuṣya* hymn for prevention of eye disorders. Similarly, *Jarāmūrīya* is prescribed for geriatric purposes.[31]

The Gopatha Brāhmaṇa says that diseases mostly break out at the junction of seasons and *yajñas* (sacrifices) are performed at the same time. Thus they are, in fact, *bhaiṣajyayajña*[32] (medical sacrifices) and work as preventive for disorders occurring in respective seasons. This is a very important observation as, on the basis of the nature of disorders, it led to the postulation of the concept of the *prakopa* (aggravation) of *doṣas* in respective seasons such as *vāta, pitta* and *kapha* in the rainy, autumn and spring seasons respectively.

Upaniṣads

The Upaniṣads throw immense light on physiological and other concepts. The Chāndogya *UP* has established the relation of *tejas, ap,* and *anna* with *vāk, prāṇa* and *manas.* It says that whatever we eat is digested and then metabolized into three portions—the gross portion is faeces, the middle one is muscle (and other *dhātus*), while a minute portion becomes *manas.*[33] Thus, it holds that food has an effect not only on body but also on the mind. This was an important observation which developed the psychosomatic concept further. Probably it was on this basis that the Gītā has classified food according to three *guṇas*[34] (mental qualities).

On the other hand, the Bṛhadāraṇyaka *UP* gives a clear picture of the cardiac cycle by analysing the word *hṛdaya* into three phases—*hṛ* (Receiving), *da* (distributing) and *ya* (movement).[35] It also describes *nāḍīs* (vessels) which transport *rasa* of various colours—white, red and blue. They may be interpreted as different blood vessels.[36]

Kalpasūtras

Sutra literature also contains valuable information. In the Śrauta sūtras we find mention of a number of plants which were used in sacrifices. The Gṛhyasūtras describe various *saṁskāras* which are helpful for promotion of qualities of body and mind. They are also referred to in Āyurvedic *saṁhitās.* The Dharmasūtras prescribe a code of conduct (*sadvṛtta*) which has been adopted in Āyurveda.

Medicinal Plants

It would not be out of place to discuss here the status of medicinal plants in the Vedic period, in order to see how far the knowledge in this field was developed. In Vedic age, man had intimate contact with the environment, particularly with plants, as he depended on them not only for his day-to-day nourishment but also for necessary appliances and instruments for domestic use and agriculture. In rites, ceremonies and sacrifices, plants played a great role in various forms. They defined a group of trees which were useful in sacrifices (*yajñiya vṛkṣa*).[37] Moreover, plants were also used as *bheṣaja* (drugs) for alleviation of the diseases of men and animals.

The ancient sages identified various plants and classified them from various angles. According to form and size, they were initially divided into two groups—*oṣadhi* (herbs) and *vanaspati* (trees). Later, each of these was again sub-divided; *oṣadhi* into *vīrudh* and *vanaspati*

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into *vānaspatya* (or *vṛkṣa*). Thus, four divisions of plants were recognized—*vanaspati, vānaspatya, oṣadhi* and *vīrudh*. The same classification continued to be followed in the post-Vedic texts.

The *oṣadhi-sūkta* of *RV* (10.97.1-23) is the authoritative document on the knowledge about plants in that age. It says that plants came into existence much earlier than the gods and have innumerable places of origin and habitat. There were flowering and non-flowering and fruiting as well as non-fruiting plants. Their morphological characters are various (*śatavicakṣaṇāḥ*) and they have various actions (*śatakratvaḥ*). They have potency like horses by which they conquer diseases in patients by circulating through all parts of the body. *Soma* was the king of herbs which were collected from far and near, out of which some were cultivated and others grew wild. For medicinal purposes their products were also mixed together and helped each other (in compound formulations). Plants were used to make man (*dvipad*) and animals (*catuṣpad*) free from disease. *Aśvattha* and *prāṇa* (among trees) and *aśvāvatī, somāvatī, ūrjayantī* and *udojasa* (among herbs) are the important medicinal plants. When a physician having complete knowledge of plants administers them, they surely exhibit favourable results. To an expert, the herbs offer themselves (to be used) and thus the *vipra* (learned physician) destroys both *rakṣas* (accidental cause) and *amīvā* (disease caused by innate factors). To such qualified physicians the patient completely surrenders himself with all his belongings. Plants are like a mother who protect the people and act for their all round welfare.

In *AV*, there is a more developed classification of plants. They are classified according to colour, morphological character, habitat (growing in plains, hills and water places) and use (*ātharvaṇī, āṅgirasī, daivī* and *manuṣyajā*—in beneficial rites, sorcery, godly remedies and generally).[38]

Use of plants in various diseases was based on experience and observation of their effects on animals like boars, mongooses, snakes and cows. Another basis was the ancient doctrine of signature such as of *haridrā* in jaundice, *lākṣā* in haemorrhage and *asiknī* in *palita*, etc.

It would be interesting to take note here of some of the important medicinal plants.

Ajaśṛṅgī: This is a shrubby, weak plant with an intense odour which repels *rakṣas*. Thus, it is a potent drug. It is also called *arāṭkī* or *tīkṣṇaśṛṅgī* (*AV* 4.37.6). Explaining the word *tīkṣṇaśṛṅgī*, Sāyaṇa says that the fruits of the plant have a strong odour and are horn-like, pointed in shape.

Ādhyaṇḍā: This plant is first encountered in *SB* (13.8.1.6). Sāyaṇa interprets it as 'having fruits in a bunch'. Dārila, in his commentary on *KSS*, has interpreted it as *parṇaphalā*. It is mentioned as *parṇaphalinī* in commentaries on *Śāṅk. Gr.* (1.19.1). What *parṇaphalā* is, is not clear. In later texts (*kapi*) *romaphalā* is a synonym for *kapikacchū*.

Apāmārga: This plant is not mentioned in *RV*. It destroys *kṣetriya*, worms, poisons and calculi and is used to counter sorcery. It is a reputed remedy for *kṣetriya roga*, improves 'digestive fire' and breaks up (lumps). The word *pratīcīnaphala* (*AV*.7.65.1) is symbolic, indicating that it rebounds the evil suffered on its perpetrator. This seems to be the source of the word *pratyak-puṣpā* a synonym of *apāmārga* in later texts.

Arundhatī: This is the *lākṣā* (lac) plant, as explicitly mentioned in *AV* (5.5.7). It is a healing and union-promoting drug. Lac is obtained from various trees like *palāśa, aśvattha*, etc. It promotes lactation in cows which have stopped yielding milk due to injury or disease. It is also used to cure *yakṣmā* in men. *KSS* (28.5.14) prescribes intake of milk boiled with *lākṣā* (a practice that still continues) and sprinkling of wounds with lac water. Pāṇini (4.2.2) has mentioned it as a dye.

Arka: The word *arka* indicates the honour (*arc* = worship) given to this plant which has come down to the present times uninterruptedly. It is spoken of as *agni* or *āditya*, which suggests its fiery nature. The word *arka* itself denoted the sun. The plant is used as an aphrodisiac. The

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arka plant is also called *anna* (food) because of its appetising and digestive functions. *SB* (10.3.4.2-5) symbolizes it as *puruṣa* and has described its different parts as simulating man's different organs. These parts are *parṇa, puṣpā, kośī, samudga, dhānā, aṣṭhīlā* and *mūla.* This shows the stage of botanical study at that time. Its botanical name is *Calotropis gigantea* (Ved. Ind. I.36).

Arjuna: In *RV* (1.222.5, etc.) this word means white, but in later *saṁhitās* and other texts it denoted a small herb which is also known as *phālguna* and is used as a substitute for *soma.* In the Kāṭhaka-saṁhitā (34.3), it is mentioned as of two types—*lohitatūla* (having red spikes) and *babhrutūla* (with grey spikes). *Arjuna* is said to be the essence of herbs and is said to have originated from the flowers of *soma.* Somewhere Sāyaṇa has alternatively interpreted it as *Arjuna* tree (*AV*.4.37.5) but it is not relevant.

Aśvattha: The mythological origin of this plant is described differently in different Vedic texts. In the Aitareya Brāhmaṇa (7.32.8.16), it is called the king of trees. In *RV* (10.97.7), it is mentioned along with *parṇa.* In *RV* (1.135.8) again *aśvattha* is interpreted as an epithet of *soma,* meaning 'pervading mountains, etc.' (*parvatādivyāptipradeśe sthitam*—Sāyaṇa). In *RV*6.47.24, it is the name of a king. The fruit of the *aśvattha* plant is called *pippala* (*RV*1.164.20.72). Sāyaṇa interprets *pippala* as *pālaka phala* (sustaining fruit). It is one of the oldest plants of India and is regarded as *yajñavṛkṣa* (sacrificial tree). This plant has come down to the present times and is mentioned with reverence extensively in texts.

Ādāra: The word occurs in *RV* (1.46.7). Sāyaṇa interprets it as an epithet of *soma* meaning that which awakens consciousness. It also means that which invokes reverence (*dṛñ ādare, ādārayati ityādāraḥ*—Sāyaṇa), but there also it may indicate a plant which exceeds or is equal to *soma* (*somasya dhṛṣṇuyā*).

In Brāhmaṇa and other literature, *ādāra* is explicitly used as a substitute for *soma.* It had ample juice which gushed out under pressure. It was also known as *pūtīka* because it had fragrance. Sāyaṇa has identified it as a grass, a creeper and a climber with latex. *Pūtīka* is referred to in some places as *ūtīka.* In later literature, *pūtīka* and *ādāra* were taken to be different plants. *Pūtīka* was one of the plants used for curdling milk and matting. It was also used internally as a diuretic.

Ādāra has been identified by G.P. Majumdar (B.C. Law Vol. I) as *Zingiber officinale,* which is commonly known as *śuṇṭhī;* and *pūtīka,* as *Caesalpinia bonducella,* but it is not known what the arguments were on which this identification was based. *Pūtīka* seems to be some kind of grass of the *Cymbopogan* sp.

Udumbara: *RV* 10.14.12 mentions *uduambala* which was modified later to *udumbara* but preserving the original sense of energy-providing. It had an important position among sacrificial items. In *AV* (19.31.1-14), there is a description of *udambaramaṇi. Bhadra* (*AV*5.5.5; *AVP* 20.3.2) is its synonym. (In *AV* 20.136.15 *bhadra* is the adjective form of *bilva* and *udumbara*). The botanical name of the tree is *Ficus glomerata Roxb.*

Upavāka (*Kā*): This has mostly been interpreted as *indrayava* (seeds of *Holarrhena antidysenterica* or *W. Tinctoria*), but it is not taken as food like rice and wheat. Moreover, *SB* (12.7.1.3) has related it to *śleṣmā* (sticky material). It occured both wild and cultivated and has strength-promoting properties. *KSS* (8.20) includes *upavāka* in *miśraḍhānya.* Here Dārila explains it as *abhiyava,* common in Saurāṣṭra.

Kanaknaka: This is a poisonous plant. According to *MK,* it denotes a poison or is an adjective qualifying *kāndāviṣa,* a species of poison. It may be *dhattūra* which is commonly known in later ages as *kanaka* because of its golden seeds.

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Karīra: This plant is related to rain and *karīrī* sacrifice is performed to invoke rain. Sāyaṇa says that these are sweet fruits found in the northern region. Flour of parched fruits (*saktu*) was used in sacrifices. In *KSS* (29.20) its root and stem are used for treatment of worms. Botanically it is *Capparis aphylla*. Sāyaṇa says that these fruits are common in Uttarāpatha (the Himalayan region). In actual fact, it is a plant which grows in arid zones like Rajasthan, Gujarat, etc.

Karkandhu: In *RV* (1.112.6) this is the name of a sage. In the Yajurveda, it denotes the red fruits of a plant. Three types of it, *kuvala* (*kavala, kvala* or *kola*), *badara* and *karkandhu* successively smaller in size are mentioned. Its *saktu* was used in sacrifices and the sweet fruits were eaten. The plant was cultivated and also grew wild. It is said to have unctuous properties. The fruits (probably sour) were used for curdling milk. An amulet of *badara* (*badara-maṇi*) is used in *snātaka-karma*.

Kuṣṭha: This plant is extensively described in *AV*. It is said to grow in the third heaven and is found with *soma*. *Viśvabheṣaja* is its epithet denoting its use in various disorders like head diseases, eye diseases, skin diseases, particularly *kuṣṭha* and *takman*. It is one of the aromatic drugs. Its identification as *Costus speciosus* is wrong. It is *Saussurea lappa*.

Khadira: This is one of the sacrificial trees. *Vibādha* is one of its synonyms. Its heartwood is very strong, of which parts of chariots, sacrificial posts and other appliances were made. It is a thorny tree on which the lac insect thrives. Patañjali, differentiating between *khadira* and *barbura* says that the (bark of the) former is flaky.

Gulgulu: This is a fragrant gum-resin obtained from the plant of the same name. It grew mostly in Sindh and was also procured from places overseas. It was a remedy (*bheṣaja*) for various disorders and was also used as incense. In appearance, it was a fleshy mass of golden colour. It was also used in veterinary medicine.

Cīpudru: This is a remedy for *vidradha, balāsa, lohita* (haemorrhage), *visarpa* and *hṛdroga*. Sāyaṇa says that it is a tree (*cīpudruḥ etatsaṁjñako drumaviśeṣaḥ*).

Jaṅgiḍa: *Jaṅgiḍa* is found mentioned only in *AV* and is a typical plant of Atharvanic tradition. It is prescribed in *takman, balāsa, jambha*, etc. *Jaṅgiḍa*, along with *śaṇa*, is said to be protective against *viskandha*. Sāyaṇa has mentioned it as a tree (*vṛkṣa*) common in Varanasi but, at another place, he says, it is an *oṣadhi* (herb) common in the northern region. Evidently these two seem to be different. Dārila (on *KSS* 42.23) interprets it as *arjuna*. Presumably on this basis mostly it is accepted as *Terminalia arjuna*. Surprisingly the word *jaṅgiḍa* does not occur in later literature.

Talāśā: This is regarded as the best among the trees. Dārila's interpretation is not clear. Keśava takes it as *vetasa*. It may be *tālīśa* which is accepted nowadays as *Abies webbiana*.

Daśavṛkṣa: This is recommended for seizure of joints. *AP* (32.1.7) mentions it in *Takmanāśana gaṇa*. Keśava (on *KSS* 27.5) takes *daśavṛkṣa* to imply ten plants, *palāśa*, etc., which is accepted by Sāyaṇa. Roth takes it to be a single tree.

Nyagrodha: This tree is also known as *vaṭa* (*AV* 20.135.3). Hanging roots establish it firmly in the ground and spreading branches provide a thick shade. That is why it has been described as the kṣatriya among plants. It is widely used in sacrifices and domestic rites. Patañjali describes it as having latex, hanging roots and thick broad leaves and calls it Nyagrodha.

Parṇa: This is the same as the *palāśa*. In *RV* (10.97.5) it is read with *aśvattha* and in *AV* with *aśvattha, nyagrodha*, etc. (5.5.5). It is one of the important sacrificial trees. It releases a reddish exudation from its bark. It is used as a panacea (*sarvaroga-bhaiṣajya*). Though '*parṇa*' like

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'*palāśa*', denotes leaves its use is earlier than that of the latter. *Kiṁśuka* (*RV* 10.85.20) denotes flowers of *palāśa* but according to Sāyaṇa it meant *palāśa* tree of which the bridal car was made.

Pippalī: This is mentioned as *rasāyana* and is a remedy for *kṣipta*, atividdha and *vātikṛta*.

Bibhīdaka: This wood was used as dice. It also produces narcosis (*madayantī*—as the seed kernel is narcotic). It is so named because of its *bhedana* property—of breaking up the faecal mass.

Bilva: This is one of the trees used for sacrificial posts. Its fruit-pulp is yellow and is eaten. *Bilva-maṇi* is prescribed for various purposes. It is one of the plants of *śānta* group.

Bhaṅga (*ā*): In *RV* (9.61.13) *bhaṅga* is interpreted by Sāyaṇa as destroyer of enemies and, thus, is an epithet for *soma*. In *AV* (11.6.15) it is clearly a herb, mentioned as one of the five kings of herbs (*pañca rājyāni vīrudhām*). Here Sāyaṇa has interpreted it as *śaṇa* (hemp). In *KSS*, all the references relate to its use as fibre. In the Kāṇva Saṁhitā (7.1.3) *bhaṅgena* has been interpreted by Sāyaṇa as *abhiṣavāmardena*, which may have some slight indication to its intoxicating property. Pāṇini (6.2.4) and then Kātyāyana in his *vārttika* on 5.2.29 mention *bhaṅgā*, which also means fibre. From the royal status it is accorded in *AV* and the copious references to it in *KSS*, it is clear that *bhaṅgā* was very popular in Atharvanic tradition.

Madugha: This is a sweet herb. It nourishes the foetus. An amulet of it is prescribed in the marriage ceremony. Dārila (*KSS* 38.17) interprets it as *jyeṣṭhīmadhuka*. It is given internally in cases of animal poisoning. *Madhuga* changes, later on, to *madhuka*.

Rajanī: This is used for colouring spots affected by *kilāsa* and *palita*. Dārila has taken it to be *methikā* while Keśava believes it is *haridrā*. The latter seems to be more likely. In later texts too, *rajanī* is a synonym of *haridrā*.

Rajjudāla: The wood of this tree is used to make sacrificial posts. It is slimy, and its penis-shaped fruit contains a slimy substance that resembles semen. *Nīcudāra* may be a synonym for the same tree. It is interpreted by commentators as *śleṣmātaka* but it seems to be a different plant which also has fruits shaped like a penis with a slimy exudation. Macdonell and Keith have identified it as *Cordia myxa* or *C. latifolia*.

Rāmā: This is one of the herbs used in the treatment of *kilāsa* and *palita*. It is identified as the *bhṛngarāja* by Sāyaṇa.

Varaṇa: The wood of this tree is used for *paridhi* (fencing) and for making several appliances. It has got remarkable medicinal properties too. An amulet of this wood was worn in *rājayakṣmā*. It is classed among the *śānta vṛkṣas*.

Vikaṅkata: This is not mentioned in *RV* though the word *kaṅkata* is mentioned (*RV* 1.192.1) which means mild poison. *Vikaṅkata* is one among the sacrificial trees which are used fresh.

Vetasa: This is mostly found in aquatic surrounding. It is one of the *śānta vṛkṣas*.

Śatavāra: This has been given the epithets *hiraṇyaśṛṅga* and *ṛṣabha*. It destroys many diseases, particularly *durṇāma* (*durṇāmacātana*).

Sugandhitejana: This is a fragrant plant used extensively in sacrifices. Its odour is strong. The Bṛhaddevatā (7.78) describes it as *snāyu* of the cosmic *Puruṣa* (*Sugandhitejanaṃ snāyu*). The commentators have interpreted it as *sugandhiṭṛṇa*. *MK* also take it to be an aromatic grass.

Soma: It was regarded as the king of herbs. It grew on the mountain known as Muñjavān and was brought from there. *Kuṣṭha* is said to be a companion of *soma*. Its juice was stimulating and was taken with milk, curd, gruel or honey. It is dealt with in detail in the ninth *maṇḍala* of *RV*. It was not easily and universally available; and some substitutes were therefore prescribed in later texts. It is called an *amṇvahā* (destroyer of diseases).

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Regarding identification of *soma*, there is a lot of controversy. If one examines the matter minutely, it becomes evident that, initially, *soma* denoted the principle which sustained and nourished plants and was in the form of water or sap. It maintained the plant kingdom in the same way as a king maintains the subjects of his kingdom. It is on this analogy that *soma* was declared as the king of herbs. Even in the earlier parts of *RV*, its character as a plant is not clear. Only in the later portion was some plant taken as a symbol of *soma*. This also is doubtful because it has lost this position in *AV* and soon in the Brāhmaṇas there appeared a long list of substitutes. In Āyurvedic treatises too *soma* is not a reality but a myth as the word was reduced to a synonym of moon and characters were set on this basis. As regards the drinking of *soma* and its consequent exhilarating effect, it was nothing but the state of divine bliss (*ānanda*). *Soma* is the lord of the wine of delight and immortality.

Haridru: In *RV* (1.50.12) it is read as '*hāridrava*' which is interpreted by Sāyaṇa as '*haritāladruma*' (*haridru*). *MK* have identified it as *Devadāru* which is incorrect.

Thus, the Vedic period was a step forward in the development of Āyurveda. Anatomy was clarified, physiology was studied, a number of disease-syndromes were defined along with their treatment, and many plants were identified and used. The foundation of the basic concepts was laid down which were crystallized in later period. It provided a sound footing on which the gigantic edifice of Āyurveda was erected and established.

4. SAMHITĀ PERIOD

Caraka-Saṁhitā

The oldest *saṁhitā* of Āyurveda available today is the *Caraka-saṁhitā* though this is not in its original form. Originally, it was composed by Agniveśa, one of the six disciples of Ātreya Punarvasu, who compiled the discussions and teachings of his guru. The entire work is in the form of a dialogue between Ātreya and Agniveśa. In its original form it was perhaps known as *Agniveśatantra* which presumably was small in size and contents. In the second phase it was enlarged by Caraka with his annotations (*bhāṣya*) and thereafter it came to be known as the *Caraka-saṁhitā*. After a long gap, by the devastation wrought by circumstances, some of portions of it were lost. These were reconstructed and restored by Dṛḍhabala. This was the third phase.

Thus, the present Caraka-saṁhitā is not the work of a single author of a definite time but has got three distinct layers of authorship, which has to be kept in mind while dating it. The three dates for the three distinct layers have been estimated as follows:

1.	Ātreya-Agniveśa	1000 BC
2.	Caraka	2-3rd century BC
3.	Dṛḍhabala	4-5th century AD

Thus, the three texts fall in the pre-Buddhist, post-Buddhist and classical periods respectively and on this basis the three layers may be analysed distinctly.

There is some controversy about the identity and date of Caraka and as such it needs discussion. Caraka came after Agniveśa in the period when Buddhism was prevalent side by side with Brāhmaṇism, the latter having the upper hand. The identity of Caraka has been sometimes confused with that of Patañjali, and after a time, the three works—the Caraka-saṁhitā, the Yogasūtra and the Mahābhāṣya—were all credited to a single author. This was perhaps due to the contemporaneity of Caraka and Patañjali. However, considering all relevant factors, it seems reasonable to place Caraka in the Śuṅga period.

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Sylvain Levi, on the basis of the Chinese translation of a Buddhist text (*Saṁyuktaratnapiṭaka-sūtra*), has established that Caraka was attached as doctor to King Kaniṣka. Even if this is accepted, it is difficult to prove that he was the same Caraka who enlarged the Agniveśatantra. Nevertheless, it certainly indicates that by that time the name Caraka for a physician, became quite common and there may have been many persons bearing this name, one of whom was the doctor to Kaniṣka.

In Vedic times, a branch of the Kṛṣṇa Yajurveda was known as Caraka. Carakas were disciples of Vaiśampāyana who himself was known as Caraka. The *sūtraṣ* of Pāṇini referring to Caraka allude to the same school. Our Caraka may have been one of the followers of this sect.[39] The branch known as *Vaidyacāraṇa* of the Atharvaveda might have been intimately related to medicine and Caraka might have been one of the physicians belonging to that school of which the members roamed from place to place offering medical service to the people.[40] The Aśvins also moved among them and treated them. Thus, by association, the word *rover* (*Caraka*) denoted *roving physicians*.[41] It seems that even the people who belonged to the Caraka school of the Black Yajurveda were somehow or other related to medicine. Perhaps that is why they were despised by Taittirīyas and the supporters of the White Yajurveda. The latter have also made Carakācārya (Head of the Carakas) as one of the victims in *Puruṣamedha*.

Gradually, Caraka was established as a school comprising wandering mendicants who practised medicine and they are mentioned along with *śramaṇa* (monks), *tīrthika* and *parivrājaka* (roaming ascetics). They also adopted *yoga* and *tantric* practices along with medicine.[42] The Carakas seem to have been close to the ājīvikas, but maintained, of course, their separate identity. The ascetic Vesiyāyana (Vaiśampāyana = Caraka) and the six *diśācaras* (Carakas) who met Makhhali Gośāla, the leader of the Ājīvika sect, seem to be none other than Carakas (see Basham, *History and Doctrines of the Ājīvika*, pp. 49-50, 56-7). But at the same time, the sect was looked down upon by the dominant sections of society because they harboured non-orthodox views, as did the tīrthikas, parivrājakas and some others. Thus, the word *caraka* also came to be used for inferior types of people commonly meaning the class to which messengers or rangers belonged. It can be presumed that Caraka was a scholar belonging to the Caraka sect which mainly gained access to the Agniveśatantra after it had been enlarged and improved upon and made a standard compendium under the title, *Caraka-saṁhitā*. Thus, the earlier tradition of the Ātreya-Agniveśa was over shadowed by the Caraka-saṁhitā, which began to represent the medical school parallel to that of Suśruta who represented the surgical school. The complete change in the name of the text cannot be explained otherwise, as it did not happen in any other cases like those of Suśruta, Kaśyapa, and others.

On going through the evidence, it appears that the Caraka-saṁhitā took shape when, though Buddhism was advancing, Brāhmaṇism still had the upper hand. The religious literature was being given concrete shape in the form of *purāṇas* and *sūtras*, and religious sacrifices were commonly performed. Such conditions prevailed during the Mauryan-Śuṅga period (3rd-2nd century BC). There is some reference to weak government, which may be taken to indicate the waning phase of the Mauryan empire when lawlessness was prevalent. The description of hospitals in *CS* also confirms this because a chain of hospitals and dispensaries was established all over his dominions during the reign of Aśoka. Patañjali, as mentioned earlier, also belonged to this period. Caraka may be placed a bit earlier than Patañjali as the Śakas, mentioned right from Patañjali to Vāgbhaṭa are conspicuously absent in *CS*.

Thus, the date of Caraka may be fixed as the third or early second century BC, at the juncture of the Mauryan and Śuṅga periods.

There is much divergence of opinion on the date of Caraka. Hoernle places Caraka between Kaniṣka and the Bower *MS*. As the Nāvanītaka contained at least twenty-five

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formulations of *CS*, Mukhopadhyaya takes him to great antiquity and says that Patañjali (second century BC) wrote a commentary on it. Meulenbeld takes a liberal view and says that Caraka's redaction of the *Agniveśatantra* already existed or was made in the first two or three centuries of our era.[43]

Contents of the Caraka-saṁhitā: The Caraka-saṁhitā has eight *sthānas* (sections) and 120 *adhyāyas* (chapters). The quadruple style of Pāṇini and Patañjali is present in remnant form in only two chapters (1,2 *Ci*). The matter of the *Sūtrasthāna* is divided into seven *catuṣkas* (quadruplets). For instance, the first quadruplet deals with drugs and is therefore called *Bheṣaja-catuṣka*; the last one is *Annapānacatuṣka* (dealing with food and drinks). Two chapters at the end are titled *Saṅgrahādhyāya* (concluding chapters).

The total number of chapters probably indicates the maximum life-span of man because the ultimate object of the treatise is to promote longevity. The contents have been detailed chapterwise in the last chapter of the Sūtrasthāna while in the Suśruta-saṁhitā, it is in the third chapter of the same. In Kauṭilya's and Vātsyāyana's works, the contents are listed at beginning of the text.

Dṛḍhabala, son of Kapilabala and born at Pañcanadapura, completed the Caraka-saṁhitā, which was then lacking one-third of its final length. Dṛḍhabala added the 17 chapters of *Cikitsā-sthāna* long with the entire *Kalpa* and *Siddhi sthānas*.[44] It is difficult to determine whether Caraka himself left this work incomplete or he had completed it but by lapse of time the text was partially lost. That the latter is the more plausible proposition seems to be indicated by the use of the word *nāsādyante* (are not available) in the earlier version for the missing chapters which were reconstructed by Dṛḍhabala on the basis of other ancient treatises.

There is some controversy as to which 17 chapters are attributed to Dṛḍhabala because there are differences in the order of the chapters in different editions, the Bengal (Jīvānanda) edition and the Bombay edition, for example. The Bombay edition is supported by most commentators and is therefore generally accepted. According to this version, 13 of the chapters originally revised by Caraka are 1-8 and those on *arśa, atisāra, visarpa, madātyaya* and *dvivraṇīya* (14,19,21,24 and 25 of the Bombay edition). The 17 chapters include those on *unmāda, apasmāra, kṣatakṣīṇa, śotha, udara, grahaṇī, pāṇḍu, śvāsa, kāsa, chhardi, tṛṣṇā, viṣa, trimarmīya, ūrustambha, vātavyādhi, vātaśoṇita* and *yonivyāpat*. Gaṅgādhara follows the order of the chapters as adopted in the Bombay edition but he takes, serially, chapters 1-13 to be as revised by Caraka and the rest as by Dṛḍhabala. Birajacharan Sengupta, however, applying criteria he has himself evolved, holds that the order approved by Cakrapāṇi is correct, except in one case where, in his view, *divraṇīya* is substituted by *udara-roga*.

On the basis of verse (*siddhi*) 12.50 it is presumed that there was also appended to the Caraka-saṁhitā an *uttaratantra* as in the case of the Suśruta-saṁhitā. Cakrapāṇi declares this view unauthoritative but it is certain that it was current even up to his own time (eleventh century AD). From this it appears that the presumed *uttaratantra* contained a detailed exposition of *tantrayuktis*, which the Agniveśatantra did not have. But again he says, in the context of the *tantradoṣa*, etc., that the author did not deal with these subjects as they are described in the corresponding Uttartantra.[45] An indication can also be observed in the present text. In fact, the Saṁhitā ends at V.40, after the concluding verses about Dṛḍhabala and his contribution, and the topic of *tantrayukti* is superimposed matter which probably formed part of the Uttaratantra. Adding an Uttaratantra or Khilasthāna was a traditional practice for improving (*upabṛṁhaṇa*) a text and is found in the case almost all the other saṁhitās (Suśruta, Vāgbhaṭa and Kaśyapa). Thus in *CS* too, the existence of an Uttaratantra cannot be ruled out. The following points are also worth noting:

1. In *SU*, ch. 1, while naming the sages who participated in an assembly, Atri's name is conspicuously left out while the other six seers of the Saptarṣi are named.

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2. The legend told elsewhere (*Ci* 4) does not tally with this one. There, Atri, not Bhardvāja, goes to Indra.
3. Except in this place, Bhardvāja does not appear again anywhere.
4. The actual subject-matter starts from the definition of Āyurveda (*SU* 1.41). Before that the tradition is traced of how the science of life was transmitted from Brahmā down to Agniveśa, etc. Thus, it is almost definite that some redactor, either Caraka or Dṛḍhabala, has manipulated the legend about the advent of Āyurveda. At least verses 6-22 are quite superfluous and can be deleted without affecting the text in any way. Perhaps the list of sages has been given only to eliminate Atri and give prominence to Bhardvāja. The entire legend can be harmonized by replacing Bhardvāja by Atri and deleting the verse 6-22.

Caraka's Contributions to the Development of Āyurveda: 1. *Rational Attitude:* During Caraka's period, Āyurveda was established on a scientific footing, classifying the entire body of the then medical knowledge on scientific lines. He was the first to introduce *yukti* (rationale) among *pramāṇas*, emphasizing the role of investigation (*parikṣā*).[46] He says that those who proceed after investigation are wise.[47] Further, he adds, 'one should, at first, examine the disease, then the drugs and finally proceed for treatment. One should always move with knowledge.'[48] That is why he established *yuktivyapāśraya cikitsā*[49] (rational medicine) apart from *daivavyapāśraya cikitsā* (spiritual medicine), which was reduced to a minimum. If we go through the *Cikitsāsthāna* (section on treatment) of *CS*, it would be evident that Caraka holds that the management of an illness starts with proper diet and drugs, and that only when human effort fails is prayer resorted to. Even today, despite advanced medical science, this is still the approach. Thus, Caraka's most outstanding contribution is his inculcation of a rational attitude towards problems of health and disease. The Vedic physician was a *bhiṣak* (*baigā* in tribal languages) who treated patients on empirical lines and mostly with magical spells; in the age of Caraka, he was raised to the status of *vaidya* (learned) though the earlier word *bhiṣak* also continued to be used. In the Rāmāyaṇa, the word *Vaidya* is generally used for *scholars* but also for learned physicians.

2. *Symposia and Seminars:* In order to disseminate his approach, Caraka introduced the method of discussion (*saṁbhāṣā*) as one of the means of attaining knowledge.[50] Symposia and seminars were arranged in different parts of the country[51] in which expert sages participated. Generally it was Ātreya who presided over these symposia. The participants put forth their views which were finally resolved by the chair. Often apparently contradictory views were declared as one-sided and all viewpoints were integrated to arrive at Truth. Ātreya says: 'It is not possible to arrive at Truth if one clings to his own views, rather he should be broad-minded to accommodate and integrate all the views.'[52]

In the beginning of *CS*, there is described a scene of a great assembly of sages, with the Himalayas in the background to consider the problem of diseases afflicting mankind.[53] A similar scene is described in *SS*.[54]

3. *Basic Concepts:* The basic concepts which were in their formative stage in the Vedic period, were crystallized and systematically established during the period of *CS*. The theory of *tridoṣa* was thoroughly systematized and applied in the realms of physiology, pathology and medicine. For explaining the action of drugs, the concepts of *rasa, guṇa, vīrya, vipāka* and *prabhāva* were established.

In the Vedas, *agni* and *soma* are described in detail. The Ṛgveda starts with hymns offered to Agni while an entire *maṇḍala* is devoted to *soma*. Vāyu already had an important place because of its relation with *prāṇa*. In the post-Vedic period these three were studied intensively and the theory of *tridoṣa* was established. It is to be noted that in the *Vātakalākalīya* chapter of

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CS, the terms *agni* and *soma* are used for *pitta* and *kapha* respectively.[55] Vāyu is *yogavāhī*, i.e. intermediary agent.

4. *Pharmacology*: Caraka defined the concepts of *rasa, guṇa, vīrya, vipāka* and *prabhāva* governing the pharmacology of drugs. He also classified drugs into fifty groups known as *mahākaṣāya*.[56]

5. *Psychosomatic Concepts*: Caraka gives importance to both body and mind. He says that both body and mind are locations of diseases. *Vāta, pitta*, and *kapha* are three *doṣas* of the body while *rajas* and *tamas* are two *doṣas* of the mind.[57] They interact with each other. In fact, in every disease one should proceed with a psychosomatic approach. In the context of fever, Caraka says that *santāpa* (heat) is *daihamānasa* (psychosomatic),[58] it does not affect only the body but also the mind. Among three types of remedies Caraka mentions *sattvāvajaya* dealing with psychiatric measures.[59]

6. *Individual Constitution*: Each individual has got its special constitution, its *prakṛti*, which has to be kept in mind while prescribing diet and drug.[60] Caraka says, 'that physician is the best who proceeds after considering the constitution from person to person.'[61] This is very important because the constitution of a living being cannot be treated as if it were a machine, and so, diet and drugs cannot be applied uniformly to all persons. One substance being wholesome to the *kapha-prakṛti* of a person may be injurious to his *pitta-prakṛti* and a *pitta-prakṛti* person would suffer badly in the intense heat of the sun and autumn season whereas a *kapha-prakṛti* person should be particularly cautious in terms of diet and movement in the spring season.

7. *The Concept of Natural Immunity*: Caraka recognized the importance of natural immunity (*vyādhikṣamatva*)[62] in the prevention and cure of diseases. This immunity again is in his view based on *ojas*, which is the essence of all *dhātus*.[63] It is also the basis of *rasāyana* therapy. The role of the *ojas* in immunity and its relation with *prāṇa* has been made clear by Caraka.[64]

8. *Expansion of Ideas*: Previously Āyurveda was known as *triskandha* or *trisūtra*, i.e. dealing with health (etiology), *liṅga* (symptoms) and *auṣadha* (remedy). Pathology, comprising *hetu* and *liṅga*, was further developed into *nidāna-pañcaka—nidāna, pūrvarūpa, rūpa, upaśaya* and *samprāpti*.[65]

9. *The Concept of Health and Disease*: Health is equilibrium (*prakṛti*) and disease is disequilibrium (*vikṛti*).[66] Philosophically, creation is *vikṛti* moving towards the ultimate goal of *prakṛti*. Similarly, disease is a transitional phase which moves on to *prakṛti*.

On the physical level, the equilibrium of *vāta, pitta* and *kapha* have to be maintained and, if it is disturbed, it has to restored, the ultimate goal being *dhātusāmya* (homeostasis). That is why the two objects of Āyurveda are defined as prevention (including promotion) and cure.[67]

On the level of mind, one should get rid of pronounced *rajas* and *tamas* and make an effort to attain the quality of *sattva*. *Sattva*, according to Caraka, is pure and provides bliss and knowledge.[68] The Gītā advocates attaining the state of *triguṇātīta* (transcending three modes) while Caraka favours that of *dviguṇātīta* as, in his opinion, *doṣas* are only *rajas* and *tamas* and not *sattva*, which has to be achieved.

Besides body and mind, Caraka also recognizes *ātman* (soul) as the supporting factor. He says body, mind and soul are a *tridaṇḍa* (tripod) supporting life.[69] Thus the approach of Caraka to health is three-dimensional, which was further elucidated by Suśruta.

In course of time *CS* attained a great reputation as an authoritative compendium on medicine. It was translated into Persian and then into Arabic in the eighth century AD, which influenced, to a great extent, the evolution of the Arab medicine.

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Suśruta-saṁhitā

In the *Bṛhattrayī* or *Vṛddhatrayī* (great or old trio) Suśruta comes after Caraka and before Vāgbhaṭa. Caraka has once quoted the views of Dhanvantari[70] which indicates that the tradition of Dhanvantari was existent even before Divodāsa and his disciple Suśruta. Even the name of Divodāsa and his son Pratardana are found in *RV*. This is confirmed by the statement of Caraka in the context of the treatment of *gulma* that, in an emergent condition, the case may be referred to a surgeon belonging to the tradition of Dhanvantari.[71]

Like *CS*, the Suśruta-Saṁhitā has many distinct layers of authorship. Besides Suśruta, Vṛddha Suśruta is also quoted in some commentaries but they do not seem to be very important. The second layer is of Nāgārjuna who is mentioned as a redactor of *SS* by Ḍalhaṇa. As there are several Nāgārjunas it is difficult to decide which of them redacted *SS*. One famous Nāgārjuna was a friend of the Sātavāhana king, as stated by Bāṇabhaṭṭa in his *Harṣacarita*. The other, belonging to the Gupta period, was an expert in *lauhaśāstra*. There are several drug formulations ascribed to Nāgārjuna. The *Amṛtasāra Lauha* of Nāgārjuna has been quoted in Cakradatta. There is also Nāgārjunī *vṛtti* which was so popular that it was inscribed on a pillar at Pāṭaliputra. Most probably, it was the author of the latter that was the redactor of *SS* as it describes a comparatively advanced use of metals. It is also said that the *Uttaratantra* in *SS* was added by Nāgārjuna.

The last manipulation of the text was done by Candraṭa as he himself has stated. It is again difficult to determine the extent of his modification. Candraṭa says that he did the *Pāṭhaśuddhi* in the Suśruta, following the commentary of Jejjaṭa.

Suśruta may be placed in the second century AD, during the reign of Gautamīputra Śātakarṇi of the Sātavāhana dynasty. Suśruta is well acquainted with places like Sahyādri and Śrīparvata in South India. Moreover, he has given a picturesque description of the plant, *Tuvaraka* (*Hydnocarpus laurifolia* [Dennst] *sleumer*) that grows on the coast of *Paścimārṇava* (the Arabian Sea).

Thus, the layers of the authorship of *SS* may be arranged according to date as follows:

1.	Vṛddhasuśruta	1000 BC
2.	Suśruta	second century AD
3.	Nāgārjuna	fifth century AD
4.	Candraṭa	tenth century AD

Contributions: 1. *Development of basic concepts*: Suśruta developed the concept of *tridoṣa* by further subdividing each *doṣa* into five types according to location and functions.[72]

2. *Definition of health*: Suśruta provided a comprehensive and ideal definition of health which covered all aspects of life.[73]

3. *Classification of drugs*: Suśruta devised a new classification of drugs based on the typical drug of the group. Moreover, he added two groups of mineral and metal based drugs which are conspicuously absent in *CS*.[74]

4. *Concept of pathology*: Suśruta advanced a concept of pathogenesis defining six distinct stages—*sañcaya* (accumulation), *prakopa* (aggravation), *prasara* (distribution), *sthānasaṁśraya* (location), *vyakti* (manifestation) and *bheda* (maturation).[75] He also classified diseases in a scientific and comprehensive way,[76] and recognized the role of blood as pathogenic agent.[77]

5. *Surgical operations*: As *SS* is a treatise that deals mainly with surgery, it describes a number of surgical operations, including plastic surgery, venesection and other parasurgical measures.[78]

6. *Knowledge of Anatomy*: Suśruta was the first author to describe a method of dissection of the human body.[79] He described in detail, bones, muscles, blood vessels, etc. He defined 107 *marmas* (vital spots) in the body and gave detailed description of them. Thus he advanced knowledge of anatomy and is rightly called the Father of Anatomy and Surgery.

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Bhela-saṁhitā

Bhela (or Bheda) was one of the six disciples of Punarvasu Ātreya. During Vāgbhaṭa's period, the *Bhela-saṁhitā* became almost obsolete in the face of the compendia of Caraka and Suśruta.

The Bhela-saṁhitā was often quoted by authors and commentators, which indicates its authoritative nature and the respect it commanded in academic circles. However, most of these quotes are not found in the presently available text of *BS*, and this raises doubts about its originality and authenticity.

BS was first published by the Calcutta University on the basis of a transcribed copy of the MS in Telugu characters preserved in the Tanjore Saraswati Mahal Library (Burnell's catalogue, p. 63, No. 10773). The MS is dated *c.* AD 1650. Another edition, based on the same source material, edited by Girija Dayalu Shukla, was published by Chowkhamba Vidya Bhawan, Varanasi, in 1959. The third and the latest edition, edited by V.S. Venkatasubramania Sastri and C. Raja Rajeswara Sarma, was published by CCRIM & H (New Delhi) in 1977. It claims to have improved upon the textual readings, and removed the errors of the previous editions which were based on transcribed copies and contained a number of mistakes. Even the single MS which is the basis of all the editions is not complete. It starts with *Sūtrasthāna*, ch. 4 (without beginning) and ends abruptly after V.38, without colophon. In between also there are several breaks.

Contributions of Bhela: 1. The *ālocaka* type of *agni* (*pitta*) is mentioned as of two types—one related to optical vision (*cakṣurvaiśeṣika*) and the other to mental vision (*Buddhivaiśeṣika*) (*Sa* 4.3-5). This is essentially the same as *cakṣurbuddhi* in *CS* (*SU* 8.12).

2. Different names are given to fevers caused in different living beings. An eruptive fever known as *vātālikā* has been described (*SU* 13.12-19).

3. A novel definition of *kāyacikitsā* is given, according to which *kāyacikitsā* deals mainly with the treatment of depressed *kāyāgni* (digestive fire or body-heat) (*Sa.* 4.18).

4. There is a separate chapter on *viṣama jvara* (*Ci* 2) in which different views about its causation are quoted.

5. The description of *pittaja kāsa* is a peculiar one. It has symptoms of hepatitis, such as yellowish sputum and eyes (*Ci* 22.9-10).

6. The *kāyacikitsaka* joins with *bhūtacikitsaka* on the one hand and with *śalyakṛt* on the other as circumstances demand (*Ci* 8.31: Ch. 29, p. 227).

Kaśyapa-saṁhitā

In the *saṁhitā* of Kaśyapa, Kaśyapa is the preceptor and Vṛddha Jīvaka the disciple who compiled all these precepts into this treatise. It is therefore known as the *Vṛddhajīvakīya Tantra.* Later, when it was no longer in tune with the age and was virtually lost, Vātsya, of the same clan, recovered it from a *yakṣa* named Anāyāsa and re-popularized it after redaction.[80]

The presently available text is based on an incomplete and mutilated single MS in the possession of Pandit Hemaraja Sarma, the guru of the king of Nepal. He has edited it with a scholarly introduction (Chowkhamba Sanskrit Series Office, Varanasi, 1953).

Kaśyapa is a pediatrician and is different from Kāśyapa, the toxicologist. Both Kaśyapa and Kāśyapa are mentioned separately. In the text of *KS*, everywhere Kaśyapa is mentioned as preceptor, somewhere only the epithet *mārīca* occurs. Thus it can be concluded that Kaśyapa, the son of Marīci, was the preceptor. Vṛddha Kāśyapa, however, is a different person who is mentioned along with other sages in an assembly presided over by Kaśyapa (*Si* 3).

Kaśyapa, the pediatrician, is quoted in the Bower MS and *AH.* Kāśyapa in the former means '*saṁhitā* of Kaśyapa'. Accordingly, the date of the Kāśyapa-saṁhitā is fixed near about the sixth-fifth century BC.

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The main subject dealt with is *kaumārabhṛtya* (pediatrics) which is said to be the foremost among the eight parts of Āyurveda. On other topics, *KS* follows Caraka and Suśruta. For instance, the number of bones (360), definition of *manas*, the nine *dravyas*, ten *prāṇāyatanas* are given according to the former, while in the *marmas* 107, *prakṛtis* (eight), or *rasāyana*, etc., it follows the latter.

Contribution of Kaśyapa: 1. The notable contributions of Kaśyapa are in the field of pediatrics. The chapters on dentition, pain, *eha, phakka, jātahāriṇī, dhūpakalpa*, etc. are quite original.

2. *Auṣadha* and *bheṣaja* are differentiated technically. The former is related to rational treatment while the latter to treatment with incantations, etc.[81]

3. In five basic pharmaceutical forms (*kaṣāya-kalpanā*), two more—*cūrṇa* and *abhiṣava*—are added, thus, making them seven.[82]

4. *Sūtikāroga* (puerperal disorders) are said to be of 64 types.[83]

5. *Amlapitta* is described. It is also called *śuktaka*.[84]

6. Topics relating to pharmacology are described in detail.[85]

7. *Kalpas* of single drugs are described in *kalpasthāna*.[86] There is also a similar description of drugs useful in eye diseases.[87]

8. *Sveda* (sudation) is said to be of eight types[88] whereas in *CS* thirteen types are mentioned.

In the Saṁhitā period, a vast literature was produced on every specialty. As recorded in *CS*, all the six disciplines of Ātreya—Agniveśa, Bhela, Jatūkarṇa, Parāśara, Hārīta and Kṣārapāṇi—composed their own *saṁhitās*[89] on *kāyacikitsā*. Likewise, in the school of surgery, Suśruta and his colleagues, Aupadhenava, Vaitaraṇa, Aurabhra, Pauṣkalāvata, Kṛtavīrya, Gopura, Rakṣita and also Bhoja, Bhadraśaunaka and some others authored their compendia.[90] In the field of *śālākya* (supraclavicular diseases) the treatises of Nimi, Karāla, Bhadraśaunaka, Sātyaki, Kṛṣṇātreya, Cakṣuṣyena among others were the important ones.[91] In pediatrics, Ḍalhaṇa mentions the works of Parvataka, Jīvaka, Bandhaka and some others,[92] while the Kāśyapa-saṁhitā was also there. In agadatantra (toxicology), Sāvitra, Ālambāyana and Nāgārjuna are mentioned in commentaries along with some others.[93]

Thus, we see Āyurveda in the Saṁhitā period was developed both in quality and quantity. The basic concepts were firmly established and the entire structure of Āyurveda was placed on a rational basis. The subject-matter was systematically arranged and classified. Methods of treatment, both in medicine and surgery, were developed to cope with the situation, including the evolution of a number of *yantras* and *śastras* (blunt and sharp instruments).

5. NON-MEDICAL SOURCES

From non-medical sources too, we get glimpses of the status of Āyurveda. These sources comprise Buddhist literature, Jaina texts, the Purāṇas, Kauṭilya's Arthaśāstra and other literary works.

Epics and Purāṇas

The great epics—the Rāmāyaṇa and the Mahābhārata—and the Purāṇas contain valuable material indicating the status of Āyurveda. In the Rāmāyaṇa, a method of preserving dead bodies in oil-tubs[94] is mentioned which is not found in *CS*. Similarly, the Mahābhārata mentions physicians and surgeons (*śalyoddharaṇakovida*)[95] along with other specialists of Āyurveda. The dialogue between Kāśyapa and Takṣaka is a proof of the former's expertise in toxicology.[96]

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Buddhist Literature

Lord Buddha lived in the Saṁhitā period and was much influenced by the scientific character of Āyurveda. He himself is called the *mahābhiṣak* and his *āryasatyacatuṣṭaya* (Four Noble Truths) is based on the logic of medicine.

Due to bias against the Vedas, the Buddhist texts refer to Āyurveda as *tikicchā* (*cikitsā*). Likewise, an *ātura* (patient) is called a *gilāna* (*glāna*). *Glāna-pratyaya* (diagnosis of disease) and *bhaiṣajyadāna*[97] (distribution of medicine) were a regular part of the activities of the Buddhist *saṅghas* and were carried out in Buddhist *vihāras* by monks and nuns. Hospitals were known as *gilānaśālā*. Vihāras played an important role in propagating Āyurveda on practical lines in the services of mankind.

Takṣaśilā, at that time, emerged as a great centre of learning where *cikitsā* was one of the important subjects of study.

Tripiṭaka texts mention five prevalent diseases—*kuṣṭha, gaṇḍa, kilāsa, śoṣa* and *apasmāra*.[98] *Pañcabheṣaja* (ghee, butter, honey, oil and jaggery)[99] of the Buddhists is a modified form of the *pañcasāra* of *SS*.

Mahāvagga (book VI) gives valuable information on diseases, their treatment and medicaments. Drugs were classified, more or less, on the same lines as in *CS*.

Kaumārabhṛtya is termed *dārakacikitsā*. The nursing system was quite elaborate. Wet-nurses (*dhātrīs*) were divided into four groups—(1) *aṅkadhātrī*, (2) *maladhātrī*, (3) *stanadhātrī*, and (4) *krīḍāpaṇikadhātrī*, according to their functions.

Surgeons were known as *sailakattiya*. Jīvaka and Ākāsagotta were eminent surgeons; the latter specialized in anorectal surgery which was disapproved by the Buddha.

Jīvaka, a contemporary of the Buddha, stands, in Buddhist tradition, as a symbol of the ideal physician as Dhanvantari does in the Purāṇas. The Mahāvagga (VIII. 1.1-29) gives a detailed account of his life and remarkable medical and surgical cures. He was a physician in the court of Bimbisāra and also attended on the Buddha and members of his order. His mother, Śālāvatī, a courtesan of Vaiśālī, had forsaken him as a child and he was brought up by Prince Abhaya in the royal palace and so he was called *Komārabhacca*. This word also indicated *kaumārabhṛtya* (pediatrics), one of the eight branches of Āyurveda, and, thus, means 'expert' in the medical treatment of children. He learnt the science of medicine from the renowned scholar-physician Ātreya at Takṣaśilā, where he studied for seven years and obtained a certificate of mastery of the subject from his teacher.

Many miraculous cures are credited to him. On his way to Rājagṛha, at Sāketa, he cured a merchant's wife who had been suffering for seven years from a head disease. At Rājagṛha, he cured King Bimbisāra of fistula by a single application of medicine and this success led to his appointment as physician to the king. He also performed a cranial operation on a merchant at Rājagṛha and drew out two worms, which cured the patient. Then he performed a laparotomy on a merchant's son at Banaras and set the twisted intestine right. He also cured King Pradyota (of Ujjaiyinī) of jaundice.

Ample material is also found in the Milinda-pañha, the Suvarnaprabhāsasūtra and the Jātakas which throw light on the then status of Āyurveda.

Jaina Tradition

Like the Buddhists, the Jainas also have a distinguished tradition of medicine which was known as *pāṇāvāya*. *Pāṇāvāya* was the twelfth *Pubba* under *Diṭṭhivāya* (*Dṛṣṭivāda*), the twelfth division of the (*dvādaśāṅga*) *āgama*. It is called *Pūrva* as it was revealed prior to Mahāvīra (the *tīrthāṅkara*) by earlier saints. This *Pūrva* was the science of vitality (*prāṇa*) which maintained the health of body and mind. It dealt with mental disciplines, dietetics and drugs, and covered all the eight *aṅgas* of Āyurveda. Jaina saints had to preserve their health and treat their sickness

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themselves and as such were required to attain requisite knowledge of hygiene and medicine.

The Jainas were very strict in observing their rules of conduct, particularly those about non-violence. They refrained from alcohol, honey and meat. Accordingly Jaina physicians modified formulations of medicinal drugs. They used mainly plants and minerals as drugs. They were practical and believed in the importance of curing disease with effective and tried medicine rather than going into philosophy and fundamental doctrines. Vaidyas traveled with their medicine-chest as well as their instrument-case and managed both medical and surgical cases.[100]

Kauṭilya's Arthaśāstra

The concept of balanced diet is already present in *CS*. The Arthaśāstra terms it *Āryabhakta*, which consisted of the following:

Rice	—	1 *prastha* (640 g)
Pulse	—	$\frac{1}{4}$ of the rice (160 g)
Salt	—	$\frac{1}{16}$ of pulse (10 g)
Fat	—	(ghee or oil) $\frac{1}{4}$ of pulse (40 g)
Meat	—	20 *palas* (80 g, prepared with fat, salt and spices)
Curd	—	$\frac{1}{2}$ *prastha* (320 g)
Vegetable (fresh)	—	$1\frac{1}{2}$ times of meat (120 g)
(dry)	—	Double the meat (160 g)[101]

Tantrayuktis, thirty-two in number, are described as in *SS*.

An important medical contribution of the Arthaśāstra is *āśumṛtaka-parīkṣā* (postmortem examination) by which the causes of death such as by hanging (*udbandha*), strangulation (*pīḍana-niruddhoccvāsa*), drowning (*udakamṛta*), poisoning, etc. were determined.[102] State control necessitated the investigation of medico-legal cases.

In the period of the Arthaśāstra there was no use of mercury or distillation. On the basis of parallelism, between the Arthaśāstra and the Suśruta-saṁhitā, it can be said that the redactor of the latter has followed the former. The *tantrayuktis* are in the *uttaratantra* which are later additions and are probably based on those in the Arthaśāstra.

Aśoka's Edicts

From his edicts it is known that Aśoka, for the welfare of the sick, had established hospitals and dispensaries in different parts of the country. He also arranged to plant avenues of trees on roads for the relief and comfort of wayfarers.[103]

Thus, by establishing chains of dispensaries and hospitals, Aśoka was instrumental in popularizing Āyurveda among the public and implementing it in the service of the sick.

6. POST-SAṀHITĀ PERIOD

In the post-saṁhitā period, when Āyurveda became service-oriented, there was need for a handbook of medicine for general physicians for whom it was not possible to study the voluminous *saṁhitās*, nor was that necessary for their job. To meet this need, such handbooks were written, *Nāvanītaka* being one of them. Earlier, the pre-classical period prepared the

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ground for works to come in the classical period, popular among them being Vāgbhaṭa's *Aṣṭāṅgahṛdaya*. It found a place in the Bṛhattrayī. In the *Aṣṭāṅgasaṅgraha*, Vāgbhaṭa says, 'it is a work appropriate to the age' (*yugānurūpa*).[104] Previously, in the saṁhitā period, treatises were composed speciality-wise, but in the post-saṁhitā period, all the specialities were in essence condensed into a handbook. *Nāvanītaka* belongs to this category.

Nāvanītaka

Nāvanītaka means cream or essence (of Āyurveda). As this implies, this work contains necessary basic instructions for physicians and describes useful and effective formulations. This is why it is also known as *siddhasaṅkarṣa* (extract of effective remedies). Probably this handbook was given to Buddhist missionaries who took it to far corners of India and abroad. Thus, it is no wonder that a MS copy was discovered in Chinese Turkistan. (Kaniṣka's rule extended to Central Asia where he constructed a number of *vihāras*).

This MS is also known as the Bower MS as it was discovered by Colonel Bower in 1890 from a *stūpa* built in honour of Yaśomitra, a Buddhist monk, near Kuchar in Chinese Turkistan. Colonel Bower handed the MS over to the Asiatic Society of Bengal which entrusted it to Dr A.F. Rudolf Hoernle for study. He completed the editing after strenuous labour over 21 years, and the Bower MS was published by the Archaeological Survey of India, Calcutta, in 1912.

The Bower MS contains seven parts. Parts I-III deal with medicine, IV-V deal with forecasts by means of dice, and VI-VII describe charms against snake-bite and other evils. The work starts with a dialogue between Kāśirāja (Divodāsa) and Suśruta (his disciple) about the properties and uses of *laśuna* (garlic). Ātreya also took part in the discussion. This implies integration of the schools of medicine and surgery which is the characteristic of the age of compilation.

Vāgbhaṭa too followed the tradition of the pre-classical age and put forward arguments in support of his integration of the two approaches. The use of garlic on a large scale was probably the legacy of the Śakas, which was followed in later texts.

Besides touching upon, more or less, all the *aṅgas* of Āyurveda, *Nāvanītaka* gives effective formulations in one of the parts. It quotes 29 formulations from *CS*, 15 from the Bhelasaṁhitā and 6 from *SS*. Moreover, formulations are quoted from the following sources:

1. Kāṅkāyana	6. Bṛhaspati
2. Suprabha	7. Agastya
3. Nimi	8. Dhanvantari
4. Uśanas	9. Jīvaka
5. Vādvali	10. Kaśyapa

Date of the Nāvanītaka

Hoernle, in his introduction to the work, fixed the date of the present MS as about AD 300 and that of the compilation of the work in the second century AD.[105]

Thus, *Nāvanītaka* is an important historical landmark in the pre-classical period which throws immense light on the climate of compilation and integration which had a great impact on the classical period.

CONCLUSION

Āyurveda is perennial and its stream has been flowing incessantly in the service of living beings. It is dynamic and progressive and is always adapting itself to the times and needs of the people. Its root is found in the prehistorical age. The Vedas reflect the conditions of the formative stage while in the saṁhitā period it was established on a scientific footing. In the

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post-saṁhitā period, it was pressed into the service of the suffering humanity and prepared the ground for the classical renaissance.

Āyurveda, as the name suggests, is concerned with life and its service is not limited to human beings but extends also to animals (*gajāyurveda, aśvāyurveda, gavāyurveda,* etc.) and plants (*vṛkṣāyurveda*).

Āyurveda and Greek Medicine

There is a striking parallelism between Āyurveda and ancient Greek medicine. The theory of humours is quite similar in both the systems. The Greeks accept four humours—phlegm, blood, yellow bile, and black bile, corresponding to *kapha, rakta, pitta* and *vāta* respectively. Āyurveda recognizes three *doṣas—vāta, pitta* and *kapha* formally, but *rakta* has also been given due status in physiology and pathology, particularly in surgery. This is testified by the fact that Caraka deals with *rakta* in a separate chapter (*SU* 24) along with the disorders caused by its vitiation, Suśruta mentions *rakta* as the fourth one, besides *vāta, pitta* and *kapha* (*SS, SU* 21.3-4). It is possible that the theory of four humours was further developed and patronized in the Greek system, which is represented by *sauda, safra, balgam* and *khūna* in the present Unānī system. This is based on the concept of four *bhūtas*—air, fire, water and earth, with their specific properties—cold, hot, wet and dry. This also corresponds to the concept of *caturbhūta* (four *bhūtas*) for all practical purposes because *ākāśa* is all-pervasive and does not involve any movement or change (see *CS, Sa* 2.31). The above properties are termed *śīta, uṣṇa, snigdha* and *rūkṣa* respectively.

Hippocrates (460 BC) is regarded as the father of modern medicine, whose ideas are collected in the text, Corpus Hippocraticus, which resembles the *saṁhitās* of Āyurveda in style and content. Caraka placed medicine on the scientific foundation of *yukti* (rationale), subduing the Vedic medicine of magic and charms. Hippocrates too revolutionized medicine in a similar way by separating it from the clutches of superstition and religion.

A unique concept of *āma* prevails in Āyurveda. Surprisingly, Greek medicine also divides fever into three stages according to the condition of *āma—āma, pacyamāna* and *pakva*. In the examination of patients, the importance of physiognomy (*ākṛti*), constitution (*prakṛti*), place (*deśa*), time (*kāla*), etc., is recognized in both Āyurveda and Greek medicine. Caraka has discussed causation of diseases due to impurity of *vāyu, jala, deśa* and *kāla* in the context of epidemics which is similarly found in Greek medicine. *Ariṣṭavijñāna* (prognostics) has been dealt with by Greek medicine as in Āyurveda. Moreover, concepts of foetal developmental, surgical operations, cauterization, blood-letting, and surgical instruments are similar in both. The Hippocratic Oath is similar to the *sadvṛtta* of Caraka, on which the medical ethics of modern medicine is based. The Greek doctrine of pneumatism, as established by Hippocrates in his manual 'On Breath', is almost on the same lines as in the *vātakalākalīya* chapter (*SU* 12) of the Carakasaṁhitā. These points of parallelism have been discussed by Filliozat (*The Classical Doctrine of Indian Medicine*, pp. 219-25) and Julius Jolly (*Indian Medicine*, pp. 22-3).

In this connection, it is necessary to trace the contact of Greek physicians with those in India. The Greek physicians presumably came in close contact with India during the empire of the Achaemenian Persians. Cyrus (558-530 BC) annexed to his empire a portion (Gandhāra) of India. This contact presumably became closer during the reigns of Cambysus (530-522 BC) and Darius I (522-465 BC). These Persian kings employed both Greek and Indian physicians in their courts. There was a land route connecting India and Greece through Asia Minor which was frequented by scholars and physicians, moving from one country to another After the invasion of Alexander, the contact between India and Greece became much closer and stronger during the period of the Mauryans.

Considering the striking points of resemblance and parallelism, the question naturally arises as to who influenced whom. In this connection, the following points may be considered:

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1. The Ayurvedic *saṁhitās* were compiled during the period of the Upaniṣads (before Buddha) near about 1000 BC, which was much earlier than the Greek manuals. Pythagorus, Plato and Hippocrates, who came later could have been influenced by the ideas and concepts of Āyurveda.

2. In the field of astronomy, the Greek contribution to Indian thought is explicitly recognized in works like the *Bṛhatsaṁhitā* of Varāhamihira but there is no mention anywhere of similar contributions in the field of medicine. This shows that, though in astronomy India borrowed something from Greece, in medicine the position was not similar. In medicine as well as in surgery, ancient India was highly advanced in comparison with other countries and, as such, any borrowing on its part from the other side does not seem probable and logical. Therefore, it may be concluded that Āyurveda rather than borrowing from, probably contributed to the formulation of ideas and concepts in Greek medicine and thereby to other systems of the world.

Āyurveda and Modern Medicine

Hippocratic medicine, as mentioned earlier, was based almost on the same foundation as that of Āyurveda but gradually; because of the dominance of the physical sciences in the west, modern medicine, which developed much later, lost practically all biological insight and, departing from the holistic approach of humours, became quite analytical. The generalizations were converted into specializations, with the result that an eye specialist was not expected to know much about the disorders of the liver or kidney. On the other hand, Āyurveda still follows the holistic approach based on the concepts of *pañcabhūta* and *tridoṣa.* The latter are vital factors which control all biological phenomena and so, their vitiation causes disorders appearing in different organs and tissues. As the basic cause of all disorders is one and the same; and treatment also is based on the same principle, varying, of course, according to their location and etiology. Hence, an Āyurvedic physician treating a disorder of the eye would not only administer eyedrops but would also prescribe medicines, such as *saptāmṛta lauha,* to be taken internally for pacification of the concerned *doṣa.* Thus the generalized biological concept and the holistic approach distinguishes Āyurveda from modern medicine, which is quite specialized and analytical in its approach to disease.

Secondly, every individual (*puruṣa*) is unique, according to Āyurveda, in his constitution and temperament, which play an important role in response to environment, diet and drugs. Āyurveda attaches much importance to the examination of patients and healthy persons to gain knowledge of their *prakṛti,* according to which the appropriate drugs and diet are recommended. Modern medicine virtually ignores this important and delicate factor, and often seems to proceed mechanically, oblivious of human variations.

The result of the mechanical approach is evident from adverse side effects produced by the majority of modern drugs. Āyurveda's view is integral and considers every individual in his constitution and prescribes drugs and diet accordingly. Thus, these may vary from person to person, who may all be apparently suffering from the same disease. Moreover, the ideal treatment, according to Āyurveda, is that which alleviates the disorder but does not produce any adverse side effect.

Āyurvedic treatment stands on the triune of diet, drug and activities but modern medicine does not attach much importance to diet. This is not unexpected because, in modern medicine, the properties and actions of the various items of diet are hardly taken into accounts, whereas Āyurveda describes their effect on *doṣa, dhātu* and *mala,* which decide their use in different conditions. That is why *pathyavijñāna* has developed as a separate branch in Āyurveda, with a substantial body of literature of its own.

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Āyurveda : A Scientific Systsem

In the Vedic age, medicine was dominated by prayer, magic and charms, but later, in the age of the Upaniṣads, the concepts of *pañcabhūta* and *tridoṣa* were developed which interpret physical and biological phenomena respectively. Physiology was studied in depth and, elucidating the crucial role of *agni* and *srotas*, the entire metabolic process leading to the formation of seven *dhātus* and *ojas* was defined. The role of *tridoṣa* (*vāta, pitta* and *kapha*) in the performance of physiological functions was also explained. Aggravation or deficiency of *doṣas* cause disorders; therefore, their pathological characters and different syndromes based on them were defined. The pharmacology was also developed by elucidating the concepts of *rasa, guṇa, vīrya, vipāka* and *prabhāva* which determine the action of drugs. Thus, Āyurveda stands on the firm scientific foundation of these concepts on which the physiology, pathology, medicine and pharmacology of Āyurveda are based. An Ayurvedist knows all this and uses drugs and diet rationally, according to different conditions, and is able to explain why he has used them and how they work, which accords with the criteria of science.

Vedic medicine was predominantly godly medicine (*daivavyapāśraya*) while Caraka labels his medicine as *yuktivyapāśraya* (rational medicine). He states that one should proceed rationally, with full knowledge of the case (see *CS, SU* 11.54; 20.20; 1.16).

Therefore, the charge that Āyurveda is unscientific or semi-scientific cannot be sustained in the face of the above facts.

There was no anaesthasia in Āyurvedic surgery. There were strong attendants (*SS, SU*5.6) who used to physically confine the patient during surgical operations (as in piles, calculus, fistula-in-ano, etc.; see *SS*, CI.6.4., 7.30, 8.4., etc.). The act was very painful and often, to minimize distress, alcoholic drinks were used. The practice of surgery, thus, seemed barbaric and therefore was despised by people and, in some cases, was restricted by government. Lord Buddha himself reproached Ākāsogotta, the famous surgeon, while he was performing an operation on a patient for fistula-in-ano and it was stopped. In my view, the lack of anaesthesia had been the main cause of the unpopularity and downfall of Āyurvedic surgery. Initially cases were treated with medicines and it was as the last resort that surgery was advised. This would be clear from Caraka's approach to the treatment of piles, for which he holds medical treatment as safest and enumerates the adverse effects of surgical and para-surgical measures (*CS, CI* 14.33-7).

According to Āyurveda, the seat of consciousness is the heart (*SS, SA* 3.31,32,34, *CS, SU* 30.4-7; Cf. Śaṅkara bhāṣya on Bṛhadāraṇyakopaniṣad 2.1.19).

Ayurvedic seers had a clear concept of the circulation of blood in the body. The word *hṛdaya* itself signifies the entire cardiac cycle (*hṛ* = to receive; *da* = to supply and *ya* = constant movement). They also had an idea about the vessels participating in the process, e.g., *dhamani* (artery), *srotas* (capillaries) and *śirā* (vein) (see *CS, SU*.30.12). What we now call blood is, according to Āyurveda, *rasa*, in which blood cells are suspended. Suśruta, dealing with the circulation of *rasa* says, 'It (*rasa*) circulates all over the body like the flow of sound, flame and water which indicates its movement in all directions—upwards, downwards and in oblique directions.' (*SS*, SU 14.16). In this process, *vyāna vāyu* takes an active part, which permeates the entire body. Caraka says that *rasa dhātu* (from heart) is pumped all over the body simultaneously and constantly by *vyāna vāyu* (*CS, CI* 15.36). Elucidating it further Bhela has said that *rasa* goes out of heart through vessels and again comes back through veins (Bhelasaṁhitā, *SU* 20.3).

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ABBREVIATIONS

AH	Astāṅgahṛdaya
AS	Astāṅgasaṅgraha
AVP	Atharvaveda Paippalāda
CS	Caraka-saṁhitā
In	Indriyasthāna
Ka	Kalpasthāna
Kh	Khilasthāna
MK	Macdonnel and Keith: Vedic Index
MV	Mahāvagga
RV	Ṛgveda
Sank Gr	Śāṅkhāyana Gṛhyasūtra
Si	Siddhisthāna
SU	Sūtrasthāna
UP	Upaniṣad
Vi	Vimānasthāna
AP	Atharva-pariśiṣṭa
AV	Atharvaveda Śaunkīya
Ci	Cikitsāsthāna
CV	Cullavagga
INSA	Indian National Science Academy
KS	Kāśyapa-saṁhitā
KSS	Kauṣikasūtra
MS	manuscript
Ni	Nidānasthāna
Sa	Śarīrasthāna
SB	Śatapatha Brāhmaṇa
SS	Suśruta-saṁhitā
U	Uttaratantra
Vaj. Sam	Vājasaneyī-saṁhitā

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13. *RV* 2.21.6, 4.19.9, 8.1.12; *AV* 5.23.1-13.
14. *RV* 8.91.1-7.
15. *RV* 1.35.9, 50.11, 191.8; 7.66.16, 10.37.4.7; *AV*.2.32.1-6; Praśnopaniṣad 1.8.
16. *RV* 1.43.4, 2.3.44; *Vaj. Sam.* 3.59, 16.49; *AV*.7.87.1.
17. *RV* 1.12.16, 79.249, 252; 3.15.1; *AV* 1.28.1-2.
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44. *CS. Ci* 30.289-90; *Si* 12.37-40.
45. Cakrapāṇidatta's commentary on *CS. Si* 12.41-5.
46. *CS, SU* 11.17; also 1.16.
47. *CS, SU* 10.5.
48. *CS, SU* 20.20; also Vi.8.68.
49. *CS, SU* 11.54.
50. *CS, Vi.* 8.6.
51. See *CS, SU* ch.1,12,25,26.
52. *CS, SU* 25.26-9.
53. *CS, SU* 1.6-17.
54. *SS, SU* 12.11-12.
55. *CS, SU* 12.11-12.
56. See *CS, SU* ch. 4 and 26.
57. *CS, SU* 1.57.
58. *CS, Ci* 3.31.
59. *CS, SU* 11.54.
60. *CS, Vi* 1.21, 8.94.
61. *CS, SU* 1.123.
62. *CS, SU* 28.7.
63. *CS, SU* 30.9-11.
64. *CS, SU* 17.73-7.
65. *CS, Ni* 1.6-13.
66. *CS, SU* 9.4.
67. *CS, SU* 30.26.
68. *CS, Sa* 5.14-21.
69. *CS, SU* 1.46-7.
70. *CS, Sa.* 6.21.
71. *CS, Ci.* 5.44.
72. *SS, SU* 21.7.
73. *SS, SU* 15.41.
74. See *SS, SU* ch. 38.
75. *SS, SU* 21.36.
76. *SS, SU* ch.24.
77. *SS, SU* 21.3.
78. *SS, SU* chs. 11,12,13,16; *Sa* ch.8; *Ci* ch.6,8 etc.
79. *SS, Sa.* 5.49.
80. *KS, Ka* 12.18-27.
81. *KS, In* 1.3-4.
82. *KS, Kh* 3.
83. *KS*, 11.7-14.
84. *KS*, 16.
85. *KS*, 3.
86. *KS*, 5,6,7.
87. *KS, Ka* 7.
88. *KS, SU* 23.25-26.
89. *CS, SU* 1.32-33.
90. *SS, SU* 3; also Ḍalhaṇa's commentary on the same.

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91. Ḍalhaṇa's commentary on *SS, U*1.5.
92. As above.
93. Ḍalhaṇa's commentary on *SS, Ka* 3.5, 7.7, 11-12, 8.120.
94. Vālmīkīya Rāmāyaṇa II. 66.14-16; VII.75.2-3.
95. Mahābhārata V.151.58; VI.120.55.
96. Ibid., I. Ch. 42, 43.
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99. *MV*VI.15.10, also see *SS, U*39.254-55.
100. R.P. Bhatnagar, *Jaina Āyurveda kā Itihāsa,* Udaipur, 1984.
101. Kauṭilya's *Arthaśāstra,* II.31.15.
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103. Rock Edict II; Pillar Edict VII.
104. *AS, SU*1.20.
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CHAPTER XXVIII

Pāṇini, Kātyāyana and Patañjali: An Overview of Sanskrit Grammatical Tradition

Rama Nath Sharma

I

Grammar, it is claimed, like many other intellectual disciplines in ancient India has its origin in the divine.[1] The subject matter (*upajīvya*) of grammar, i.e., speech (*vāc*), itself has been accorded a divine status. It is stated that *vāc* is the essence of man and the Vedic *ṛk* is the essence of *vāc*.[2] The study of speech by the time of the ancillary texts of the Vedas (*vedāṅgas*) had already gone past the stage of curiosity. The *saṁhitā* and *prātiśākhya* texts formed the basis for systematic investigation into phonetics and phonology. It is an undisputed fact that ancient Indians had established the study of articulation of speech as a scientific discipline way before other ancient civilizations. The origin of grammatical study can, thus, be traced back to the Vedic hymns of northwest ancient India, more particularly to their *saṁhitā* and *padapāṭha* techniques of recitation. What started out as the analysis of components of an utterance into words (*padas*) gave rise to the development of a linguistic description based on notions of bases (*prakṛti*), affixes (*pratyaya*), and operations (*kārya*) relatable to them.[3] Rules of grammar were formulated by abstracting generalizations of speech with reference to related exceptions (*apavāda*) and negations (*pratiṣedha*). These generalizations were not made as cold abstract generalizations. They were made within the warm perspective of usage (*loka*), though largely ritualistic in nature at the beginning. This human perspective of abstracting generalizations is important to bear in mind, especially in the context of theorizing about the intellectual endeavours of ancient India.

Pāṇini's *Aṣṭādhyāyī* (henceforth the *A*) comes at a stage when intellectual pursuits had moved to the analysis of words as part of sentences. That Pāṇini chose to formulate a finite set of serially, and/or even otherwise, ordered *sūtras*[4] (henceforth also 'rules') to account for the infinity of utterances of Sanskrit language was no accident. For the *sūtra*-style of describing reality in the realm of knowledge had become well established by his time. It is true that Pāṇini's *A* stands as the single most remarkable treatise in the field of Sanskrit grammatical speculation. However, it will be a mistake to believe that the technique of capturing generalizations of speech by means of general (*sāmānya*), particular (*viśeṣa*) and residual (*śeṣa*) rules (*lakṣaṇa*), along with their related exceptions (*apavāda*) and negations (*pratiṣedha*), was something new developed by Pāṇini. Instead, Pāṇini's *A* developed as a remarkable body of *sūtras* presenting the most systematic and complete grammar of the Sanskrit language, or for that matter, of any language to date. It developed as what now can be viewed as the

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culmination of an extremely rich grammatical tradition. A tradition which begins with the *padapāṭha* recitation of the Vedic texts and which, after a brief preoccupation with etymologies, moved toward developing some solid foundation for description of speech. It is claimed, and to a larger extent correctly, that there were 85 known grammarians prior to Pāṇini. Pāṇini himself mentions ten of them in his *A*. The *brāhmaṇa, saṁhitā, upaniṣad* and the earlier classical literary texts, such as the *Mahābhārata* and *Rāmāyaṇa* indicate that grammar (*vyākaraṇa*), by their time, had become an established discipline of learning. Patañjali, while emphasizing that grammar was included in the curriculum of a brāhmaṇa-initiate, uses the expression *purākalpa etad āsīt*, 'this was the situation in ancient times'.[5] A time frame so ancient to Patañjali must be very ancient for us. The *A* is rightly regarded as 'one of the greatest monuments of human intelligence.'[6] Pāṇini's fame had even reached the young (*ākumāraṁ yaśaḥ pāṇineḥ*).[7]

Pāṇini's date is still a matter of some debate among scholars. Mīmāṁsaka (1973) argues that Pāṇini's date must be accepted some three thousand years before Vikramāditya (57 BC). Such a date for Pāṇini is rather impossible to defend. Vasudeva Sharan Agrawal[8] believes that Pāṇini lived around 450 BC. A fifth to sixth century BC time for Pāṇini can be defended on the basis of linguistic evidence. Examples related to dynastic rulers such as Puṣyamitra Śuṅga and Mahāpadmananda, and also those to Darius,[9] help place Pāṇini around that time. Furthermore, references to two coins, i.e. *viṁśatika* and *kārṣāpaṇa*, also offer justification for placing Pāṇini close to 6-5th century BC. We have various interpretations of linguistic evidences by scholars such as Goldstucker, Weber, Bhandarakar, Renou, Bohtlingk, Sircar, Jaiswal and Mīmāṁsaka. Refer to Cardona (1980)[10] for a judicious summary of these views.

Pāṇini, Kātyāyana and Patañjali are regarded as the three sages (*trimuni*) of grammar where each succeeding *muni* enjoys comparatively greater authority (*yathottaraṁ munīnāṁ prāmāṇyam*) than his predecessor. We are in a much better position to determine Patañjali's time as 150 BC. Kātyāyana's time is generally accepted as 3rd century BC, especially in light of examples such as *śākapārthiva* and *devānāṁ priyaḥ*. This makes him contemporaneous with Aśoka. Since Patañjali organized his *bhāṣya* discussions around the *vārttikas* of Kātyāyana, accepting a lead time of 150 years between Kātyāyana and Patañjali is not unreasonable. The *vārttikas* of Kātyāyana were formulated as statements, similar in many ways to scholia, to clarify that which a *sūtra* of Pāṇini under-represents, overstates or fails to state; and to augment the formulation, interpretation and application of the *sūtras*. We find that usages of Pāṇini's time also differ from those of Kātyāyana's time. That is, Pāṇini does not account for certain usages which were available at Kātyāyana's time. But this should not be accepted as an oversight on Pāṇini's part. It is hard to believe that a meticulous observer of Pāṇini's calibre missed these usages. We must then accept them as innovations. For such innovations to innovate and become established in usage, we must also allow some time. To accept a time difference of 150 years between Pāṇini and Kātyāyana is, thus, also not unreasonable.

Pāṇini's *A* represents the peak of grammatical speculation in India. Perhaps it was the excellence of the *A* which rooted out all competition. Other treatises in the field of grammar met with the same fate. Kātyāyana and Patañjali together represent the developmental aspect of the Pāṇinian system of grammatical study. We much later also witness the theorization (*siddhānta*) aspect of this system in the *Vākyapadīya* of Bhartṛhari (AD 5th century), *Vaiyākaraṇabhūṣaṇa* of Kauṇḍabhaṭṭa (AD 17th century) and *Vaiyākaraṇasiddhāntalaghumañjūṣā* of Nāgojibhaṭṭa (AD 17th century). The *Rūpāvatāra* of Dharmakīrti (AD 11th century) marks the beginning of the *prakriyā* tradition of applied texts of Sanskrit grammar. It also marks the beginning of the decadence of a grammatical study which, passing through the *Prakriyākaumudī* of Rāmacandra (AD 16th century), came full circle with the *Siddhāntakaumudī* of Bhaṭṭojidīkṣita (AD 17th century). The *Laghukaumudī* of Varadarāja (AD 17th century) marks the end of this remarkable tradition.

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II

Four types of interrelated texts, namely *sūtra, vṛtti, vārttika* and *bhāṣya,* which follow from one another beginning with the first, best represent the organizational structure of grammatical thinking. A *sūtra,* an algebraically condensed formulaic statement or rule, must form the basis for *vṛtti,* its paraphrase. A *vārttika* identifies problems with, and offers possible resolutions to, aspects of formulation, interpretation, order and application of individual rules. A *bhāṣya* begins where a *vārttika* leaves off. It systematically examines aspects of formulation, interpretation, order and application of individual rules as brought into focus by individual *vārttikas.* A *bhāṣya,* by way of its discussions, also offers resolutions to problems raised by the *vārttikas.* That is, a *bhāṣya* conclusion may accept, reject or otherwise modify a *vārttika* proposal (Sharma, 1987 : pp. 1-2).[11]

The *A* of Pāṇini is the earliest fully available text of the inventory of *sūtras* (*sūtrapāṭha,* hence forth the *SP*) on Sanskrit grammar. All other bodies of grammatical rules are much subsequent in time and inferior in quality. All post-Pāṇinian grammatical developments in India have been greatly influenced by the *SP* of Pāṇini. Mīmāṁsaka (1973) claims, on the basis of internal evidence, that there were several *vṛttis* on the *SP,* including one which Pāṇini himself wrote. Unfortunately, the *Kāśikāvṛtti* of Vāmana and Jayāditya (AD 6) is the only full-length *vṛtti* available to date on the *SP* of Pāṇini. The *bhāṣya* literature is also very limited. We have only one such text, namely the *Mahābhāṣya* (henceforth the *Bhāṣya*) of Patañjali. Incidentally, the *vārttikas* of Kātyāyana are found only in the *Bhāṣya* of Patañjali. The *Mahābhāṣya* is a fairly large commentary presented in 85 day-sessions (*āhnikas*). However, Patañjali does not include discussions on all the *sūtras* of the *SP.* Kātyāyana also has not formulated *vārttikas* on all *sūtras* of Pāṇini. Since a *bhāṣya* discussion must have a *vārttika* as its focus (*pratīka*), absence of a *vārttika* on a particular rule also means absence of a related *bhāṣya* discussion. More on the *vārttikas* and *bhāṣya* later.

Pāṇini's *A* contains nearly four thousand *sūtras* presented in eight book-chapters (*adhyāya*) of four quarters (*pāda*) each. The *SP* of the *Aṣṭādhyāyī* has come down to us through oral tradition. It is remarkable that the text, except for a few interpolations, pre-Pāṇinian inserts and variant readings, has remained intact. A *sūtra* has to be brief, precise and unambiguous. It should accomplish brevity and precision, though certainly not at the expense of clarity. Pāṇini's *sūtras* can be compared with formulaic statements which generally lack verbs. These *sūtras* must be interpreted within their shared context. That is, a *sūtra* is not an independent statement. It shares interpretational and functional contexts with other rules, both locally as well as globally within the *A.* Proper interpretation of a *sūtra* by means of reconstruction of shared contexts is referred to as *ekavākyatā,* single sentenceness, in the Pāṇinian parlance.[12] Consider, for example the following rule where I indicate endings of its individual words with 1/1 (nominative singular), 6/1 (genitive singular) and 7/1 (locative singular) :

> 6.1.100 *iko yaṇ aci (ikaḥ 6/1 yaṇ 1/1 aci 7/1),*
> where a sound denoted by $y^{a}N$ is to occur in place of another sound denoted by *iK,* when a sound denoted by *aC* follows

This replacement operation is offered in the context of *saṁhitā* (6.1.72 *saṁhitāyām;* cf. 1.4.109 *paraḥ sannikarṣaḥ saṁhitā,* 'extreme proximity between sounds') with the exception, of course, of 6.1.101 *akaḥ savarṇe dīrghaḥ,* which offers a single corresponding long vowel (*dīrgha 1/1 = dīrghaḥ*) as a replacement for a sequence formed by *aK* (*ak 6/1 = akaḥ*) with a following homogenous sound (*savarṇa 7/1 = savarṇe*). Our interpretation of rule 6.1.100 with its context, as defined by 6.1.72, includes an exception (*apavāda*) in the form of 6.1.101. Notice how 6.1.72 itself relies on 1.4.101 for interpretation of its definitional term *saṁhitā.* The

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idea that a sound denoted by *iK*, when occurring before a sound denoted by *aC*, constitutes the focus of a replacement operation derives from rules 1.1.49 *ṣaṣṭhī sthāneyogā*, 'a genitive when not interpretable otherwise means "in place of"' and 1.1.66 *tasminn iti nirdiṣṭe pūrvasya*, 'a specification made by locative (*saptamī*) indicates an operation on what precedes'. That a sound denoted by y^aN comes as a replacement is known from the structure of the rule construed with *bhavati* as the verb.

But what about *ik*, *yaṇ*, *ac* and *ak* of *ikaḥ* (*iK 6/1*), *yaṇ* (y^aN *1/1*), *aci* (*aC 7/1*) and *akaḥ* (*aK 6/1*), respectively? These are abbreviatory terms (*pratyāhāras*), formed with the help of rule 1.1.73, *ādir antyena sahetā*, whereby an item on the list, when joined together with another item not on the list, produces an abbreviatory term (*pratyāhāra*). Pāṇini prefaced his *Aṣṭādhyāyī* with fourteen formulaic statements called the *Śivasūtras* (henceforth the *Śs*) to present the inventory of sounds (*varṇa-samāmnāya*) of the Sanskrit language (See Sharma, 1990: pp. 1-4).[13] The *Śs* perhaps represents the oldest of all abbreviatory techniques. I present the fourteen *Śs* as follows where non-list items are presented with capital letters and raised lowercase *a* is meant for facilitating articulation :

1. *a i u Ṇ*
2. *ṛ ḷ K*
3. *e o Ṅ*
4. *ai au C*
5. $h^a y^a v^a r^a T$
6. *l Ā Ṇ*
7. $ñ^a m^a ṅ^a ṇ^a n^a M$
8. $jh^a bh^a Ñ$
9. $gh^a ḍh^a dh^a S$
10. $j^a b^a g^a ḍ^a d^a Ś$
11. $kh^a ph^a ch^a ṭh^a th^a c^a ṭ^a t^a V$
12. $k^a p^a Y$
13. $ś^a ṣ^a s^a R$
14. $h^a L$

Recall that *iK* is to be replaced with y^aN where each abbreviatory term refers to four items. How should one decide equivalency of individual segments of two sets? Pāṇini offers rule 1.3.10, *yathāsaṁkhyam anudeśaḥ samānām*, whereby we learn that equivalency of items in two sets of equal numbers is determined on the basis of order of enumeration. Thus, individual elements of *iK*, i.e., *i*, *u*, *ṛ* and *ḷ*, are replaced with *y*, *v*, *r* and *l* respectively. Besides, a replacement must be most proximate to what it replaces (1.1.50 *sthāne' ntaratamaḥ*). It is no surprise that proper interpretation of a single rule, for example 6.1.100, should require over twenty other rules to be brought close to its context.

Pāṇini presents his rules in blocks or domains where larger domains can also contain interior and sub-interior domains. Each domain has a heading rule (*adhikāra*). A heading rule, either by itself or with the help of some additional following rules, defines the functional context of its domain. The *A* is arranged in eight book-chapters (*adhyāya*) where each has four quarters. Placement of rules in larger domains crosses *adhyāya* boundaries. Nearly half of the *A* is headed by rule 3.1.1, *pratyayaḥ*, which covers three *adhyāyas*. Rules 3.1.91, *dhātoḥ*, and 4.1.1, *ṅyāp-prātipadikāt*, constitute two of its interior domains covering most of its rules. Over six hundred rules are contained within yet another larger domain headed by 6.4.1, *aṅgasya*. Each heading rule, along with rules forming the functional context of a domain, is carried to all rules contained within that domain. A rule within an interior or sub-interior domain also carries the reading of heading rules of its own domain and may also, where needed, carry the reading of a preceding rule or part(s) therefrom, for its proper interpretation. This process

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of mandatory and desired reading of preceding rules or their parts in subsequent rules of a domain is termed *anuvṛtti*, recurrence. Rules of heading (*adhikāra*), interpretation (*paribhāṣā*) and definitional terms (*saṁjñā*), when brought along with elements of recurrence, determine the meaning of a given *sūtra*. The system of *anuvṛtti* is not free of problems. Our best source for resolutions of knotty issues is always the exposition of the learned.[14]

A complex network of rule relations, which also includes serial placement and functional hierarchy, determines proper application of a *sūtra*. Consider rule 8.2.1, *pūrvatrāsiddham*, which is responsible for creating a functional division of the *A* in two parts: the *sapādasaptādhyāyī*, the first seven and one quarter chapters, and *tripādī*, the 'last three quarters'. Rules 1.4.1 *ā kaḍārād ekā saṁjñā*, and 1.4.2, *vipratiṣedhe paraṁ kāryam*, identity a particular kind of rule conflict (*vipratiṣedha*) in the *sapādasaptādhyāyī*. Such conflicts are resolved in favour of a subsequent rule (*para*). Rule 3.1.92, *tatropapadaṁ saptamīstham*, identifies an element within the domain of the 3.1.91 *dhātoḥ*, as a conjoined word (*upapada*), when the same is specified with a locative (*saptamī*). Additional conflict among rules are anticipated and resolved by rules 3.1.93, *kṛd atiṅ*, and 3.1.94, *vā' sarūpo' striyām*. The first rule states that an affix other than one denoted by a *tiN* is termed *kṛt*. The second rule defines an interior domain within the domain of 3.1.91 *dhātoḥ* with the exclusion of rules headed by 3.3.94, *striyāṁ ktin*. It allows for a particular affix (*viśeṣa*) to block its general counterpart (*sāmānya*) provided it is formally dissimilar to that. Recall that blocking of a general rule by its particular is a norm in the Pāṇinian parlance.

Pāṇini describes the Sanskrit language by identifying *padas* (1.4.14, *suptiṅantaṁ padam*) and analyzing their constituency in terms of bases (*prakṛti*) and affixes (*pratyaya*). A string of base(s) and affix(es) with a network of operations finally derives a given *pada*. Grammarians caution that this postulation of bases, affixes and network of attendant operations is strictly all the product of their imagination. It will be an error to accept Pāṇini's grammar as a grammar which derives words and not sentences. A *pada* cannot be properly understood without its syntactic context. Pāṇini derives sentences by way of deriving their constituent *padas* simply because of strategic reasons. Consider the derivation of the following sentences:

(*i*) *putro' gninā bhṛtyāya sthālyām odnaṁ pacati*
the son is cooking rice in a pot with fire for the servant

(*ii*) *putreṇāgninā bhṛtyāya sthālyām odanaḥ pacyate*
rice is cooked by son for the servant with fire in a pot.

Pāṇini will derive these sentences with reference to abstract syntactic representation where action (here denoted by *pac*) will form their central meaning. This action, lexicalized as *pac* with the signification of *viklitti*, softening, has to be accomplished by an agent (*kartṛ*; 1.4.54, *svatantraḥ karttā*). Each action based on its own nature names its participants (*kārakas*). The agent comes as given. Thus, the action complex of sentence (*i*) can be represented as follows, where I also show the named participants lexicalized:

(*iii*) Action (*viklitti*) *pac*

Participants:

kartṛ 'agent' (1.4.54 *svatantraḥ karttā*): *putra*
karman 'object' (1.4.49 *kartur...*) : *odana*
karaṇa 'instrument' (1.4.42 *sādhakatamam...*): *agni*
sampradāna 'dative' (1.34.32 *karmaṇā yam...*): *bhṛtya*
adhikaraṇa 'locus' (1.4.45 *ādhāraḥ...*): *sthālī*

A string composed of items lexicalised as (*iii*) is required to be processed by grammar for identification. This, in turn, yields the following information:

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(*iv*) Action (*pac/<dhātu>* (1.3.1 *bhūvādayo dhātavaḥ*)
putra/kartṛ: <prātipadika (P)> (1.2.45 *arthavad* ...)
odana/karman: <prātipadika (P)> (1.2.45 *arthavad* ...)
agni/karaṇa: <prātipadika (P)> (1.2.45 *arthavad* ...)
bhṛtya/sampradāna: <prātipadika (P)> (1.2.45 *arthavad* ...)
sthālī/adhikaraṇa: <prātipadika (P)> (1.2.45 *arthavad* ...)

Elements of this string must now scan the grammar for access to domains of possible rule application. A search, limited only to the examination of heading rules, whether or not they contain definitional terms with which input items have been identified, makes scanning a lot faster. Our first element, i.e., *pac*, is sent to the domain of 3.1.91 *dhātoḥ* since this rule is a heading and it contains the definitional term *dhātu* assigned to *pac*. The rest of the items are all sent to the domain of 4.1.1, *ṅyāp-prātipadikāt*, which is also a heading rule and which contains the definitional term *prātipadika* by which these stems are all identified.

An action is accomplished within the temporal perspective of present, past and future. The action denoted by *pac* is to be accomplished at the current time. An affix (3.1.1, *pratyayaḥ*) denoting an action at the current time (*vartamāne*), namely *LAṬ*, will be introduced after (3.1.2, *paraś ca*) *pac*. Further, since a *LA* affix is to be introduced after a transitive verbal root when *kartṛ*, agent or *karman*, object, are to be expressed, a decision must be made as to what will be expressed here with the selection of *LAṬ* (3.4.69, *laḥ karmaṇi ca bhāve cākarmakebhyaḥ*). A similar affix can be introduced after an intransitive verbal root when agent and *bhāva*, root-sense are to be denoted. This context of introducing *LA* affixes with the option of expressing agent, object and root-sense, brings yet another aspect of conceptualizing action complexes. That is, an action can name its participants but expressing at least two of these participants, namely, agent and object, can also be accomplished by the *LA* affixes. Expressing other named participants via diverse affixal operations is also possible. The option of not expressing the agent of an intransitive action by verbal endings can be availed of when a choice is made to express root-sense (*bhāva*) by the verbal ending. Clearly then, 'naming' and 'expressing' must be accepted as two concepts relative to participants in action (refer to Sharma, 1987, pp. 187-212, for further details).

A decision to express the agent, lexically identified here as *putra*, will yield the string of the action indexed as follows:

(*v*) *pac/dhātu*: 1.3.1, *bhūvādayo dhātavaḥ*
↦ 3.1.91, *dhātoḥ*, 3.2.123, *vartamāne laṭ*
= *pac* + *LAṬ <+kartṛ>* # 3.4.69, *laḥ karmaṇi* ...

Step six will similarly yield:

(*vi*) *pac* + *LAṬ* ↦ 3.4.77, *lasya*/3.4.78, *tip-tas-jhi* ...
#1.4.99 *laḥ parasmaipadam*/1.4.100, *taṅānāv ātmanepadam*
1.4.101 *tiṅas trīṇi* .../1.4.102, *tāny ekavacana* ...

Notice how a possible rule application is guided by terms indexed with the input. Furthermore, each new element introduced into the string requires reconstruction of contexts relative to that term. Thus, a term such as *dhātu*, guided the input to the domain of 3.1.1.–3.1.2. (3.1.91, *dhātoḥ*) where *LAṬ* was introduced. Reconstruction of the context of *LAṬ* brings rules marked with # in the string. The index of *pac*, thus far, can be represented as follows:

(*vii*) Action *<vartamāna> pac <dhātu>/<sakarmaka>*
= *pac* + *LAṬ < ([+ kartṛ])>*
= *pac* + *LAṬ* ↦ *tiṄ <(LA*-replacement*)/parasmaipada) >*
= *pac* + *tiP <prathama [ekavacana/sārvadhātuka)>*

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The last term *sārvadhātuka* introduced by (3.4.113, *tiṅśit sārvadhātukam*) will, via reconstruction of its related contexts lead to 3.1.68, *kartari śap*, whereby we will get:

(*viii*) $\mapsto$ *pac* + (*Ś*)*a*(*P*) + *ti*(*P*) = *pac* + *a* + *ti*

A similar scanning procedure and rule application will yield the following indexed string of nominals:

(*ix*) *putra* <*prātipadika*(*P*)/(*kartṛ*[–])>
(*x*) *odana* <*prātipadika*(*P*)/(*karman*[+])>
(*xi*) *agni* <*prātipadika*(*P*)/(*karaṇa*[+])>
(*xii*) *bhṛtya* <*prātipadika*(*P*)/(*sampradāna*[+])>
(*xiii*) *sthālī* <*prātipadika*(*P*)/(*adhikaraṇa* [+])>

A *[+]* at the end of these indices reminds that the named participants must be expressed with the nominal endings. A *[–]* will block the expression of *kartṛ* by a nominal ending since the same is already expressed by the *tiP* of *pac*. The term <*prātipadika*> will lead the strings to the domain of 4.1.1, *ṅyāp-prātipadikāt*, where 4.1.2, *svaujas* ..., will introduce a set of twenty one affixes classified into seven sets of three each, named *prathamā, ḍvitīyā, tṛtīyā*, etc. The three individual endings in each set are termed *ekavacana, dvivacana* and *bahuvacana*, respectively. Note that reconstruction of contexts of related rules triggered by terms added to the index of individual strings not only directs future steps in derivations but also resolves questions relative to selectional restrictions. For example, nominal endings are twenty-one and the verbal endings are eighteen. What determines the selection of one ending, i.e., *tiP*, after *pac* at step (*vii*)? Similarly, what will decide the selection of *sU, am, Ṭā, Ne* and *Ni* after *putra, odana, agni, bhṛtya* and *sthālī* to denote the nominal stem notion (*prātipadikārtha*; 2.3.46 *prātipadikārtha* ...), object (*karman*; 2.3.2, *karmaṇi dvitīyā*), instrument (*karaṇa*; 2.3.18, *kartṛkaraṇayos tṛtīyā*), dative (*sampradāna*; 2.3.13, *caturthī sampradāne*) and locus (*ādhāra*; 2.3.36, *saptamy adhikaraṇe ca*), respectively? Reconstruction of related rule contexts alone (see Sharma 1987: pp. 187-212 and Sharma 1978[15] for further details) can answer these questions.

Deriving (*xv*), *putraḥ agninā bhṛtyāya sthālyām odanam pacati*, from

(*xiv*) *putra* <*prātipadika* (*P*)/(*kartṛ* [–])>
agni<*prātipadika* (*P*)/(*karaṇa*[+]>
bhṛtya <*prātipadika*(*P*)/(*sampradāna* [+])>
sthālī <*prātipadika* (*P*)/(*adhikaraṇa* [+])>
odana <*prātipadika* (*P*)/(*karman* [+])>/
Action <*vartamāna*> *pac* <*dhātu*>/<*sakarmaka*>

where

pac <*dhātu*>+ *LAṬ* < ([+*kartṛ*])>
= *pac* + *ŚaP* + *tiP* <*prathama/ekavacana/sārvadhātuka*>

produces

(*xv*) *putraḥ agninā bhṛtyāya sthālyām odanam pacati,*

through phonological rule applications almost automatically. Deriving sentence (*ii*), *putreṇāgninā bhṛtyāya sthālyām odanaḥ pacyate*, 'rice is cooked by the son for the servant with fire in a pot', a passive counterpart of (*i*), is easy. Both these derivations will have a common path till step (*vi*) where a decision as to whether *LAṬ* is to express *kartṛ* is made. A decision to express *kartṛ* will produce sentence (*i*). A decision to express object with a replacement of *LAṬ* will block the introduction of accusative (*dvitīyā*) after *odana*. We will then get *odanaḥ* from *odana*+*sU*, expressing nothing but the nominal stem notion. An agent not expressed with the

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replacement of *LAṬ* will then have to be expressed with an instrumental (*tṛtīyā*) ending after *putra* yielding *putreṇa*. Sentences (*i*) and (*ii*) can, thus, be derived as related structures. I have shown elsewhere (Sharma, 1987) how other related structures can also be derived with common strings. For an excellent discussion of this, as well as aspects of positing basic derivational forms at the outset, see Cardona (1997).[16]

III

Pāṇini hardly speaks about principles based on which he formulated his *SP*. We find a great deal of discussion concerning developmental principles of grammar in the *Vyākaraṇa-mahābhāṣya* of Patañjali. It has been stated that *vārttikas* are statements found in the *bhāṣya* where they serve as units of focus. They focus on things which have not been (*anukta*) stated, or if they have been (*ukta*), have been poorly (*durakta*) stated, in the *sūtras*. Note that *vārttikas* have become synonymous with the *vārttikas* of Kātyāyana, just as *bhāṣya* has become synonymous with the *Mahābhāṣya* of Patañjali. This is simply because we do not have any *vārttika* and *bhāṣya* literature dating prior to the time of Kātyāyana and Patañjali. The total number of *sūtras* on which Kātyāyana offers his *vārttikas* is 1245. Kielhorn claims the total number of his *vārttikas* to be 4293 (Sharma, 1987). Are these correct numbers? Why did Kātyāyana not offer *vārttikas* on other *sūtras*? These are no easy questions. First of all, *vārttikas* are available to us as part of the *Mahabhāṣya*. Kielhorn (in Staal, 1972) effectively shows how they can be recognized by an immediately following paraphrase of Patañjali as a clue. However, not all *vārttikas* recognised by this method are accepted by commentators. Answering the second question is more difficult. Perhaps Kātyāyana did not find it necessary to add *vārttikas* on all the *sūtras* of Pāṇini. Perhaps *vārttikas* on rules not included in discussions of the *Mahābhāṣya* of Patañjali were lost. It is my thinking that Kātyāyana wrote *vārttikas* on many more *sūtras* of the *SP*. Perhaps Patañjali excluded them from his discussion in the *Mahābhāṣya*.[17]

The purpose of a *vārttika* can be established only with reference to the structure of the *bhāṣya* in which it serves as focus. Joshi (1968: iii-iv)[18] characterizes the discussion of the *Mahābhāṣya* as a 'sustained argument' and identifies its pattern as consisting of 'question (objection)-answer'. Since an objection has to be refuted or affirmed, based on its examination in the light of examples and counter-examples, an objection may have counter-objections which again may be refuted or affirmed. The purpose of a *bhāṣya* is to make a *sūtra* fully understood. The purpose of a *vārttika* is to serve as focus for, and thus complement, the *bhāṣya* discussion of a *sūtra*.

Many still have the impression that Kātyāyana formulated his *vārttikas* to find faults in the *sūtras* of Pāṇini. By focusing more on the *vārttikas* which Patañjali accepted and which seek certain modifications in the wording or scope of a *sūtra*, people regard Kātyāyana as an antagonist of Pāṇini. They also think that Patañjali was the champion defender of Pāṇini against Kātyāyana. Kielhorn (in Staal, 1972) is correct in observing that Pāṇini has suffered more at his [Patañjali's] hands than those of the *vārttikakāra's*. Patañjali claims that not even a single letter of a *sūtra* is meaningless. Yet in his *Mahābhāṣya* he declares many of the *sūtras* as meaningless. Can we say that Patañjali was trying to find faults in the *SP* of Pāṇini? I think that it was a common practice to explain *sūtras* by raising doubts against aspects of their formulation, interpretation, order and application, by means of examples, illustrations, counter-examples and counter-illustrations. This is what Patañjali calls exposition (*vyākhyāna*). The tradition accepts it as the most important source of properly comprehending a *sūtra*. It can also be viewed as putting a *sūtra* to test. This testing is indeed thorough and the *Mahābhāṣya* of course, by treating *vārttikas* as units of focus in this process, does it commendably. It has also been stated that the Sanskrit language had changed by the time of Kātyāyana. To account for

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this change Kātyāyana formulated his *vārttikas*. While the existence of linguistic changes between the times of Pāṇini and Kātyāyana cannot be ruled out, accepting the formulation of *vārttikas* as an attempt toward accounting for those changes is unrealistic (see Sharma, 1987, for additional details).

The *Mahābhāṣya* of Patañjali is regarded as the second most important grammatical text after the *A*. As has been stated, its aim is to present a necessary *vyākhyāna*, exposition, on the *SP*. It is claimed (Sharma, 1968)[19] that Patañjali commented on 1701 *sūtras* of Pāṇini. This exposition is available in 85 day-sessions (*āhnikas*) where the first is rightly called the *paspaśāhnika*, introductory day-session. The order of *sūtras* selected for exposition follows to Pāṇinian listing. The discussions of the *Mahābhāṣya* are rendered as dialogues or structured arguments with a *vārttika* of Kātyāyana or, occasionally, a statement from Patañjali. For an example, consider his very first unit of focus: *siddhe śabdārthasambandhe*. The tradition recognizes three participants in the discussion: the student (*śiṣya*), teacher's aide (*ācāryadeśīya*) and the teacher (*ācārya*). There are also references to two more participants: one who knows only part of the truth (*ekadeśin*) and the other who offers the final view (*siddhāntin*).

A *bhāṣya* discussion thematically centres on two things: what is given as established and whether or not that can be accepted. A *sūtra*, *vārttika* and some statement of Patañjali can be accepted as given. Whether it can be accepted as established depends on what kinds of doubts are raised against it . If a doubt is satisfactorily resolved the statement is accepted. If not, modifications are proposed, discussed and accepted.

Patañjali begins the *Mahābhāṣya* by accepting *atha śabdānuśāsanam*, 'here commences instruction about words', as the unit of focus (*pratīka*). Questions are then raised about the meaning of the word *śadba*, its nature (*svarūpa*) and the purpose (*prayojana*) of formulating and studying grammar (*śabdānuśāsana*). At the time when the discussion is moving toward word as the subject matter of grammar, Patañjali offers yet another *pratīka* through a *vārttika*:

> *siddhe śabdārthasambandhe*, 'given that word (*śabda*), meaning (*artha*) and their inter-relationship (*sambandha*) are eternal (*nitya*) ...'

The discussion now centres on what is eternal (*nitya*), its sense (*nityatva*) and types of eternality, particularly *kūṭasthanityatā* and *pravāhanityatā*. The word *nitya* refers to a thing which remains fixed (*dhruva/kūṭastha*), is not modified, does not move from one stage of existence to another, sustains no loss or gain and retains its basic elements (*tatva*) even when destroyed. This retention can be viewed as eternality (*nityatā*) in continuum (*pravāha*), like speech passed on from one generation to another. A word is spoken, and when spoken brings about the understanding of its meaning. The spoken word is, thus, the manifestation of the eternal characterized as *kūṭastha*. This is passed from generation to generation still eternal, though in a continuum. This discussion of the *bhāṣya* can be treated as precursor to the development of the idea of word as the Supreme (*śabdabrahman*). Many other aspects of the philosophy of language, for example, word as a class (*jāti*) and individual (*vyakti*), on the one hand, and substance (*drvya*), quality (*guṇa*) and action (*kriyā*) on the other, have also been discussed. Questions about words and what they mean are also raised and answered (see Sharma, 1987; pp.12-14).

The *paspaśāhnika* also discusses the nature and function of grammar (*vyākaraṇa*). Patañjali does not approve of *pratipadapāṭha*, enumerating the totality of words, as an effective means of learning. For, Bṛhaspati taught Indra for one thousand heavenly years following this technique and could not see the end. What of us mortals today? If one lives long, one lives to be a hundred. A study of words must be based on generalizations. That is, rules of a general nature, with related exceptions, must be extracted. This, in turn, will enable the understanding of the great ocean of words by means of less effort. These generalizations must be made from usage (*loka*) where the language of the *śiṣṭas*, the learned, forms the standard. Who are

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the learned? The *brāhmaṇas* who in this country of Āryas (*i*) possess but one small pitcher of grains as their property, (*ii*) who are not greedy, and (*iii*) who, without any ulterior motive of gain, have gone across at least one field of knowledge. Those venerable *brāhmaṇas* are the learned. A grammarian believes in the authority of words (*śabdapramāṇa*). The world of grammar follows the outside world of usage (*loka*), notwithstanding, however, that things may happen differently in these two worlds.

Now consider a couple of popular maxims (Sharma, 1987, pp. 42-59) which, in addition to many others, Patañjali manipulates to illustrate rule interaction and conflict resolution. This use of maxims, perhaps, best captures the essence of the human perspective brought to bear upon grammatical speculation in ancient India.

(*i*) *dadhi brāhmaṇebhyo dīyatāṁ takraṁ kauṇḍinyāya* 'let curds be given to brāhmaṇas and buttermilk to Kauṇḍinya'

This injunction illustrates *takra-kauṇḍinya-nyāya*, where a conflict may arise since Kauṇḍinya is also a brāhmaṇa. A general injunction of *dadhidāna*, gift of curds, here comes into conflict with the particular gift of buttermilk (*takradāna*). Since this general injunction of *dadhidāna* will become vacuous if Kauṇḍinya is given *dadhi*, Kauṇḍinya must be given *takra*. This particular injunction of *takradāna* must block its general counterpart. Can Kauṇḍinya be given *dadhi* after he has received *takra*? No, the general must yield a domain of application to its related particular. They cannot be applied in turn (*paryāya*). That is, similar to the practice in the outside world, a general rule once blocked, must remain blocked forever (*yad bādhitam tad bādhitam eva*). Remember, however, that an exception can be blocked by a corresponding negation (*pratiṣedha*). This is the subject matter of our next maxim.

(*ii*) *devadattasya hantari hate devadattasya punar unmajjanaṁ na bhavati*, 'killing the killer of Devadatta does not bring Devadatta back to life.

A general rule is here likened to Devadatta who, in turn, is killed by its particular counterpart. What if a negation rule kills this particular, as is the practice in grammar? Killing the killer cannot bring Devadatta back to life. That is, once dead, Devadatta is dead for ever. But this is the reality of the outside world. In the world of grammar, once Devadatta's killer is killed, Devadatta may become alive again. That is, a general rule, once blocked by its related particular, may apply again after the particular is blocked by negation. This, indeed, is contrary to the reality of the outside world.

Pāṇinīyas have used this reality of the outside world to bear upon the inside world of grammar, extensively. Modern linguists are seeking answers to questions regarding rule-formulation, interpretation, ordering and application. Since Pāṇini successfully wrestled with these problems, linguists find his grammar surprisingly contemporary. Advances in computer-based studies on language acquisition, function, and artificial intelligence, have brought new focus to the exemplary brevity of the Pāṇinian rules. All this, however, must be pursued without drifting away from the usage (*loka*). For a person in need of a pot may go to the potter and ask, 'Make a pot, I want to make use of it', but he cannot go to a grammarian and ask, 'Make words, I want to use them'.

NOTES AND REFERENCES

1. *brahmā bṛhaspataye provāca bṛhaspatir indrāya indro bharadvājāya bharadvāja ṛṣibhya ṛṣayo brāhmaṇebhyaḥ.* 'Brahmā explained it to Bṛhaspati, Bṛhaspati to Indra, Indra to Bharadvāja, Bharadvāja to the sages and sages to the Brāhmaṇas, [Ṛktantra (I/4), In Mīmāṁsaka (1973), vol. I: p. 58: *Saṁskṛta Vyākaraṇa-Śāstra kā Itihāsa*, Sonipat: Ram Lal Kapoor Trust).
2. *Taittirīyasaṁhitā (1.1)*

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3. *Gopathabrāhmaṇa* in Mīmāṁsaka, op. cit.: ... *ko dhātuḥ kiṁ prātipadikaṁ kiṁ nāmākhyātaṁ kiṁ liṅgaṁ kiṁ vacanaṁ kā vibhaktiḥ kaḥ pratyayaḥ kaḥ svara upasargo nipātaḥ kiṁ vai vyākaraṇaṁ ko vikāraḥ ko vikārī'*... What is a root? What is a nominal stem? What are nominals and verbals? What is gender? What is a number? What is inflectional ending? What is an affix? What is accent? What is a pre-verb, a particle? What is grammatical analysis? What is modification? What gets modified?
4. The word *sūtra* literally means thread. Since it is a must for any weaving (*avāpa*) it is also principal (*tantra*). A *sūtra* in grammar can be safely represented as a brief and precise algebraically condensed non-independent formulaic statement loosely translated as 'rule'. A *sūtra* of the *A* is referenced by following the convention of b.q.n where b = book (*adhyāya*) number, q = quarter (*pada*) number and n = number of individual rule (*sūtra*). Thus, a reference made with the sequence of three ones separated with two periods, for example 1.1.1, will (when read in reverse) refer to the first rule of the first quarter of the first book.
5. The *Mahābhāṣya* of Patañjali (on 1.1.1 *vṛddhir ādaic*): *purākalpa etad āsīt saṁskārottarakālaṁ brāhmaṇā vyākaraṇaṁ smādhīyate*; 'this was the situation in ancient times: the Brāhmaṇa-initiates studied grammar'.
6. Leonard Bloomfield, *Language* (1931: p. 5). New York: Henry Holt.
7. I Tsing [7th AD; in Staal (ed.), 1972: *A Reader in Sanskrit Grammarians*. Cambridge, MIT Press] recalls that Nālandā (in the north-east) and Valabhī (in the north-west) were two great centres of learning. Some graduates of these centres, with their fame, made the five mountains vibrate. Their renown flowed over the four borders. This goes more in consonance with the interpretation of *ākumāraṁ yaśaḥ pāṇineḥ*, 'Pāṇini's fame extended as far down as to the Cape Comorin'. That is, not interpreting *kumāra* as referring to the young students.
8. Vasudev Sharan Agarwal, (1963): *India As Known to Pāṇini*. Varanasi: Prithivi Prakashan.
9. Pāṇini describes the Kṣatriya principalities (*janapada*) of his time in great detail. He himself was a resident of Gāndhāra which, during the reign of Darius (521-486 BC), became part of the Iranian empire. The Kṣatriya principalities of the region extending from Pañcāla to Mithilā were annexed to the Magadha empire by Mahāpadmananda (465 BC). It is therefore safe to assume that Pāṇini flourished during the time when the Kṣatriya principalities were still not annexed to the Iranian and Magadha empires (see Agrawal, 1963, for additional details).
10. George Cardona, (1980): *Pāṇini, A Survey of Research*. Delhi: Motilal Banarasidass.
11. Rama Nath Sharma, (1987): *The Aṣṭādhyāyī of Pāṇini* (vol. I). New Delhi: Munshiram Manoharlal.
12. *na videśasthamiti kṛtvato nānāvākyaṁ bhavati. videśastham api sad ekaṁ vākyaṁ bhavati*, 'a rule does not become a different rule simply because it is placed far away from another; even a rule placed far away can share single-sentenceness'; in *Vyākaraṇamahābhāṣya of Patañjali* (vol. III: p. 392). Rohtak, Gurukul Jhajjar.
13. Rama Nath Sharma, (1990): *The Aṣṭādhyāyī of Pāṇini* (vol. II). New Delhi: Munshiram Manoharlal.
14. Patañjali on Pāṇini 1.3.11, *svaritenādhikāraḥ: na jñāyate kiyantam avadhim adhikāro' nuvartate*, 'it is not known how far a heading carries'.
15. Ram Nath Sharma, (1978): Referential Indices in Pāṇini, *Indo-Iranian Journal* XVII:31-9.
16. George Cardona, (1997): *Pāṇini, His Work and Its Traditions*, Vol. I, Delhi.
17. It is hard to believe that Kātyāyana offered his *vārttikas* only on less than one third of the total rules of the *A*. It is equally difficult to assume that Patañjali did not discuss them in his *Mahābhāṣya*. Since these texts developed within a fairly established tradition of grammatical discourse, it is not out of place to imagine that many other *vārttika* and *bhāṣya* texts were lost. The number of texts and recensions of the *vārttika* and *Mahābhāṣya* which we currently have may not be the same that Kātyāyana and Patañjali authored.
18. S.D. Joshi, (1968; ed., tr.): *The Vyākaraṇamahābhāṣya of Patañjali, Samarthāhnika*. Poona: University of Poona.
19. K. Madhava Krishna Sarma, (1968): *Pāṇini, Kātyāyana, and Patañjali*. Delhi: Kendriya Samskrit Vidyapeeth. p. 53.

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D.P. CHATTOPADHYAYA, M.A., LL.B., Ph.D. (Calcutta and London School ofeconomics), D. Litt. (*Honoris Causa*), researched, studied Law, Philosophy and History and taught at various Universities in Indiaasia, europe and USa from 1954 to 1994. Founder-Chairman of the Indian Council of Philosophical Research (1981-1990) and President-cum-Chairman of the Indian Institute ofad - vanced Study, Shimla (1984-1991), Chattopadhyaya is cur rently the Project Director of the multidisciplinary 96-Vol. Project of History of Indian Science, Philosophy and Culture (PHISPC) and Chairman of the Centre for Studies in Civilizations (CSC). among his 37 publications, authored 19 and edited or co-edited 18, are *Individuals and Societies* (1967); *Individuals and Worlds* (1976); *Sri Aurobindo and Karl Marx* (1988); *Anthropology and Historiography of Science* (1990); *Induction, Probability and Skepticism* (1991); *Sociology, Ideology and Utopia* (1997); *Societies, Cultures and Ideologies* (2000); *Interdisciplinary Studies in Science, Society, Value and Civilizational Dialogue* (2002); *Philosophy of Science, Phenomenology and Other Essays* (2003); *Philosophical Consciousness and Scientific Knowledge: Conceptual Linkages and Civilizational Background* (2004); *Self, Society and Science: Theoretical and Historical Perspectives* (2004); *Religion, Philosophy and Science* (2006); *Aesthetic Theories and Forms in Indian Tradition* (2008) and Love, Life and Death (2010). Besides, he held high public offices, namely, of Union cabinet minister and state governor. He was awarded Padma-bhushan in 1998 and Padma Vibhushan in 2009 by the Government of India.

G.C. PANDE, thinker, scholar, historian, regarded internationally as an authority on Buddhism and ancient Indian culture, joined the University of Allahabad, his *alma mater*, as Lecturer in History after receiving his D. Phil in 1947. Later he became Professor and Head of the Department of History of three universities– Gorakhpur, Jaipur andallahabad. at present, he is the Chairman, allahabad Museum Society and the Chairman-cum-President, Indian Institute ofadvanced Study, Shimla.

Recipient of many honorary degrees (Vida Varidhi, Sahitya Vacaspati, Vakpati, Mahamahopadhyaya) and awards (Sankara Sammana, Manisha Sammana, etc.), he has lectured and traveled extensively in India and abroad. He has authored and edited several distinguished book and contributed over seventy articles to encyclopaedias, anthologies and journals. His *Studies in the Origins of Buddhism, Foundations of Indian Culture, Bharatiya Parampura Ke Mool Swara* and other books brought him encomiums from scholars such as Gopinath Kaviraj, Rahul Sankrityayan, Suniti Kumar Chatterji, Khetresh Chattopadhyaya, Vasudev Saranagrawal, T.R.V. Murti, I.B. Horner, H.nakamura and Louis Renou.

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